M. BLVNDEVILE
HIS
EXERCISES,

Contayning eight Treatiſes, the Titles whereof are ſet downe in the next Printed Page: which Treatiſes are very neceſſary to be read and learned of all yong Gentlemen *that haue not beene exerciſed in ſuch Diſciplines, and yet are* deſirous to haue knowledge as well in *Coſmographie, Aſtronomie*, and *Geographie*, as alſo in the *Art of Nauigation*, in which Art it is impoſſible to profit without the helpe of theſe, or ſuch *like Inſtructions.*

To the furtherance of which *Art of Nauigation*, the ſayd Maſter BLVNDEVILE ſpecially wrote the ſaid Treatiſes, *and of meere good will doth dedicate the ſame to* all young Gentlemen of this REALME.

The ſixth Edition corrected and augmented.

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THE TITLES OF THE TREATISES Contained in this BOOKE.

FIrſt, a very eaſie Arithmeticke, ſo plainely written as any man of a meane capacitie may eaſily learne the ſame, without the help of any teacher.

Item the firſt principles of Coſmographie, and eſpecially a plaine treatiſe of the Spheare, repreſenting the ſhape of the whole world, together with the chiefeſt and moſt neceſſarie vſes of the ſaid Spheare.

Item a plaine and full deſcription of both the Globes, as well Terreſtriall as Celeſtiall, and all the chiefeſt and moſt neceſſarie vſes of the ſame, in the end whereof are ſet downe the chiefeſt vſes of the Ephemerides of *Iohannes Stadius*, and of certaine neceſſarie Tables therein contained, for the better finding out of the true place of the Sunne and Moone, and of all the reſt of the Planets vpon the Celeſtiall Globe.

Item a plaine and full deſcription of *Peter Plancius* his vniuerſall Mappe, lately ſet forth in the yeare of our Lord 1592. containing more places newly found, as well in the Eaſt and Weſt Indies, as alſo towards the North Pole, which no other Mappe made heretofore hath, whereunto is alſo added how to finde out the true diſtance betwixt any two places on the land or ſea; their longitudes and Latitudes being firſt knowne, and thereby you may correct the Skales or Tronkes, that bee not truely ſet down in any Map or Carde.

Item, A briefe and plaine deſcription of M. *Blagraue* his Aſtrolabe, otherwiſe called the Mathematicall Iewell, ſhewing the moſt neceſſary vſes thereof, and meeteſt for ſea men to know.

Item, the firſt and chiefeſt Principles of Nauigation more plainely, and more orderly taught then they haue beene heretofore by ſome that haue written thereof, lately collected out of the beſt moderne Writers, and treaters of that Art.

Item, a briefe deſcription of vniuerſall Mappes and Cardes, and of their vſe: And alſo the true vſe of *Ptolemie* his Tables; together with the true order of making the ſaid Tables. And of all other Maps and Cards as well vniuerſall as particular, and that according to the Doctrine of the beſt Geographers that bee, or haue bin in theſe latter dayes.

Item, the true order of making of *Ptolemie* his Tables, and alſo the making of all other Tables, Maps or Cardes, as well vniuerſall as particular, and that according to the doctrine of the beſt Geographers that bee or haue beene in theſe latter dayes.

And moreouer, I haue thought good to adde vnto mine Arithmeticke, as an appendix depending thereon, the vſe of the Tables of the three right lines belonging to a circle, which lines are called Sines, lines Tangent, and lines Secant, whereby many profitable and neceſſarie concluſions, as well of Aſtronomy, as of Geometrie are to bee wrought onely by the helpe of Arithmeticke, which Tables are ſet downe by *Clauius* the Ieſuite, a moſt excellent Mathematician, in his Booke of demonſtrations made vpon the Spheriques of *Theodoſius*, more truely printed than thoſe of *Monte Regio*, which Booke whiles I read at mine owne houſe, together with a Louing Friend of mine, I tooke ſuch delight therein, as I mind (God willing) if God giue me life, to tranſlate all thoſe propoſitions, which *Clauius* himſelfe hath ſet downe of his owne, touching the quantity of Angles, and of their ſides, as well in right line Triangles, as in the Sphericall Triangles, of which matter, as *Monte Regio* wrote diffuſedly, and at large, ſo *Copernicus* wrote of the ſame briefly, but therewith ſomewhat obſcurely, as *Clauius* ſaith. Moreouer, in reading the Geometrie of *Albertus Durerus*, that excellent painter, and finding many of his concluſions very obſcurely interpreted by his Latine Interpreter (for hee himſelfe wrote in high Dutch) I requeſted a friend of mine, whom I knew to haue ſpent ſometime in the ſtudie of the Mathematiques, not onely plainely to tranſlate the foreſaid *Durerus* into Engliſh, but alſo to adde thereunto many neceſſary propoſitions of his owne, which my requeſt hee hath (I thanke him) very well performed, not onely to my ſatisfaction, but alſo to the great commodity and profite of all thoſe that deſire to bee perfect in Architecture, in the Arte of Painting, in free Maſons craft, in Ioyners craft, in Caruers craft, or any ſuch like Art commodious and ſeruiceable in any common Wealth, and I hope that hee will put the ſame in print ere it bee long, his name I conceale at his owne earneſt intreatie, although much againſt my will, but I hope that hee will make himſelfe knowne in the publiſhing of his Arithmeticke, and the great Art of *Algebra*, the one being almoſt finiſhed, and the other to be vndertaken at his beſt leaſure, as alſo in the Printing of *Duretus*, vnto whom hee hath added many neceſſary Geometricall concluſions, not heard of heretofore, together with diuers other of his workes, as well in Geometry, as in other of the Mathematicall Sciences, if hee bee not called away from theſe his ſtudies by other affaires. In the meane time I pray all young Gentlemen and Sea-men to take theſe my labours already ended in good part, whereby I ſeeke neither prayſe nor glory, but onely to profite my Country.

To

To the Reader.

I Greatly reioyce to ſee ſo many of our Engliſh Gentlemen, both of the Court and Country in theſe dayes, ſo earneſtly giuen to trauell as well by Sea as Land, into ſtrange and vnknowne Countries, and ſpecially into the Eaſt and Weſt Indies, following therein the good example of diuers worthie Knights & Gentlemen, that haue ventured their liues to diſcouer ſtrange Countries to the great honor of their Country & to their owne immortall fame. And becauſe that to trauell by ſea requireth skil in the Art of Nauigation, in which it is impoſsible for any man to be perfect, vnleſſe he firſt haue his Arithmatike, and alſo ſome knowledge in the principles of Coſmographie, and ſpecially to haue the vſe of the Spheare, of the two Globes, of the Aſtrolabe, and croſſe-ſtaffe, and ſuch like inſtruments belonging to the Art of Nauigation, I thought good therfore to write the Treatiſes before mentioned, to ſerue as an introduction for ſuch young Gentlemen as haue not been exerciſed in ſuch kind of ſtudies, which treatiſes if they ſhal vouchſafe to read with attentiue mind, and in ſuch order as they are before ſet downe, I doubt not but that it will cauſe them hereafter to ſeeke for further knowledge therein. And in any wiſe I wiſh them to begin with my Arithmeticke, the contents whereof are declared in the next Chapter following, In the meane time I doe earneſtly requeſt all young Gentlemen, to take theſe my ſimple Pamphlets no leſſe thankefully than they haue done my Horſe-booke, and in ſo doing, I ſhall haue iuſt cauſe to to thinke my labour well beſtowed

What

What cauſe firſt moued the Author to write this Arithmeticke, and with what order it is here taught, which order the contents of the Chapters thereof hereafter following doe plainly ſhew.

I Began this Arithmetik more than ſeuen yeers ſince for a vertuous Gentlewoman and my very deare friend M. Elizabeth Bacon, *the daughter of Sir* Nicholas Bacon *Knight, a man of moſt excellent wit, and of moſt deepe iudgement, and ſometime Lord Keeper of the great ſeale of* England, *and lately (as ſhe hath beene many yeeres paſt) the moſt louing and faithfull wife of my worſhipfull friend M. Iuſtice* Windham, *not long ſince deceaſed, who for his integrity of life, & for his wiſdome and iuſtice daily ſhewed in gouernment, and alſo for his good hoſpitality deſerued gret commendation. And though at her requeſt I had made this Arithmeticke ſo plaine and eaſie as was poſſible (to my ſeeming) yet her continuall ſicknes would not ſuffer her to exerciſe her ſelfe therin. And becauſe that diuers hauing ſeene it, and liking my plaine order of teaching therein, were deſirous to haue Copies thereof, I thought good therefore to print the ſame, and to augment it with many neceſſary Rules, meete for thoſe that are deſirous to ſtudie any part of Coſmographie, Aſtronomie, or Geographie, and ſpecially the Arte of Nauigation, in which without Arithmeticke, as I haue ſaid before, they ſhall hardly profite. But now to returne to my matter, the contents of this Arithmeticke are theſe here following. Firſt, hauing defined what Arithmeticke is, & what numeration or numbring is, and of what parts it conſiſteth, and how to number any great ſumme written in many figures, I deale with the foure ſpeciall kinds of Arithmetick, that is, Addition, Subtraction, Multiplication and Diuiſion. Then I ſhew the order of working in whole numbers, called in Latine* Integra, *by the rule of proportion, otherwiſe called the golden rule, or the rule of three; Then I treat of broken numbers called fractions, ſetting downe ſeuen neceſſary Rules belonging therunto, by the helpe whereof you ſhall be the better able to adde, ſubtract, to multiplie and diuide the ſame. That done, I ſhew how to vſe the rule of three, as wel in dealing with ſole Fractions, as with Fractions anexed to Integrums, which rule of three is threefold, that is, the common rule, the rule reuerſe, & the double rule, the order of all which three kinds, I doe plainly teach by examples, ſhewing wherein, how and when they are to be vſed. Next to thoſe I ſet down the rule of fellowſhip, a neceſſarie rule for thoſe that haue to traffique in in any trade of Merchandiſe, giuing diuers examples thereof. Next to that I treat of Arithmetical and Geometricall Progreſſion, and alſo of Proportion, and of the three kinds thereof, that is, of Proportion Arithmeticall, Geometricall and Muſicall. Then I ſhew how to find out the ſquare root of any number, and alſo the vſe therof, in ſetting of Batels, & alſo how to find out the cubique roote of any number: & laſt of all I treat of Aſtronomicall fractious, ſhewing how to adde, to ſubtract, to multiplie, & diuide the ſame, and alſo to take the ſquare roote thereof, without the knowledge of which Fractions, you can neuer calculate any thing truely out of the Aſtronomicall Tables.*

Some perhaps do look here that I ſhould ſpeak ſomwhat of the rules of Algebra, *wherby al ſubtle & intricate queſtions of Arithmeiicke are to bee vnfolded, wherewith I leaue indeed* *deale, partly for that I haue not of long time exerciſed my ſelfe therein, & partly becauſe I know that one hath begun to write thereof, whoſe Booke being once ended, I doubt not but that he will ſhortly after print the ſame to the great profit and furtherance of all thoſe that delight in ſuch good exerciſes. But in the meane time I haue thought good to adde (as I haue ſaid before) vnto this Arithmeticke a plain deſcription, together with the vſe of the Tables of Sines, of Lines Tangent and Secant, which Tables will pleaſure many that would gladly know how, and wherein to vſe them, and ſpecially ſuch Seamen as haue ſome taſte of Arithmeticke, without the which no good almoſt is to be done in any ſcience.*

This

The Treatiſe of Arithmeticke, contayneth twentie ſix Chapters, as followeth.

Of

And immediately after theſe Chapters, doe follow the vſe of the Tables of Sines, Lines Tangent, and Lines Secant before mentioned, together with the Tables themſelues.

M. BLVNDEVILE HIS EXERCISES, CONTAINING EIGHT TREATISES.

The firſt Treatiſe.

CHAP. I.
Of Arithmeticke.

WHat is Arithmeticke?

It is the Art of counting or numbering by figures.

What is to number by figures?

It is to expreſſe the value of any number in his proper Characters & figures, which is called by a Latine name Numeration.

What belongeth to Numeration?

Two things, to know the ſhapes of the figures, and ſignification of their places.

How many figures are there?

Theſe ten, 1.2.3.4.5.6.7.8.9.0. whereof the tenth made like an o. as you ſée héere, is called a Cypher, which is no number of it ſelfe, but ſerueth only to fill vp a number.

What is number?

Number is a collection or ſumme of many ones or vnities added together.

How is number diuided?

Into thrée kinds; that is, Digit, Article, and Compound.

Which be they?

The Digit is any of the firſt nine Figures before ſet downe. Article is any number ending in tenne, as ten is one Article, twentie is two Articles, thirtie is thrée Articles, &c. Compound is that which is compounded of Article and Digit, as 13.14.17.24.&c.

Shew what ſignification euery Digit hath according to his place, and in what order ſuch place is to be conſidered in expreſſing any number?

The order as touching the place, is to beginne at the right hand, and ſo to procéed towards the left hand. For any of the nine Digits whatſoeuer, ſtanding in the firſt place, which is on the right hand, ſignifieth the value of himſelfe only, in the ſecond place tenne times himſelfe, in the third place an hundred times himſelfe, in the fourth place a thouſand times himſelfe, in the fifth place tenne thouſand times himſelfe, in the ſixth place an hundred thouſand times himſelfe, in the ſeuenth place a Million, in the eighth place ten Millions, in the ninth place an hundred Millions, in the tenth place a thouſand Millions, &c.

Doth the Cypher ſignifie nothing?

Alone it ſignifieth nothing, otherwiſe it maketh a place whereſoeuer it ſtandeth, ſo as it be not the outermoſt on the left hand: for there it hath no place at all, as hére you may ſée in this number, 04500. Whereof the firſt Cypher on the right hand, ſignifieth the firſt place, the ſecond Cypher the ſecond place, but the outermoſt Cypher on the left hand, ſignifieth no place at all, becauſe it hath no Digit ſtanding before it towards the left hand, and therefore though in this number there be fiue figures, yet it ſignifieth no more then if there were but foure, viz. foure thouſand and fiue hundred.

By what meanes may a great number written in many figures, be readily expreſſed or told?

By diuiding the ſame into diuers parts with ſtrékes or prickes made at the end of euery third figure, beginning to tell from the right hand towards the left, as in this number: 4/320/570. In which, beginning with the Cypher on the right hand, I tell one, two, and thrée, and there make a ſtréke, and ſo procéeding forth ſtill towards the left hand, I make a ſtréke at the end of euery third figure, by which ſtrékes or partitions I make them now generall numbers, and euery ſtréke muſt bée named by his ſeuerall denomination. Notwithſtanding, in expreſſing this number being thus diuided, or any other ſuch like, you muſt begin at the left hand, and ſay in this Example thus, foure Millions, thrée hundred twenty thouſand, fiue hundred and ſeuentie: for by reaſon of this Diuiſion, the Figure 4. ſtandeth hére alone, and in the firſt place, and indéed ſignifieth foure Millions, and by that meanes, you may fitly expreſſe the ſaid number in ſaying as afore, thus, foure Millions, thrée hundred and twentie thouſand, fiue hundred and ſeuentie. And the better to diſcerne the Millions from the reſt in great numbers, it ſhall not be amiſſe to ſet an M. ſignifying Millions, right ouer the head of the ſtréke which is drawne betwixt the ſixth and ſeuenth Figures, 34/545^{m}/678/694. which is to be vttered thus, thirty foure thouſand, fiue hundred, fortie fiue Millions, ſixe hundred ſeuenty eight thouſand, ſixe hundred ninety and foure crownes or pounds, or whatſoeuer other denomination or name it ſhall pleaſe you to giue them.

Chap. II.
Of the foure ſpeciall kinds or parts of Arithmeticke.

Which are thoſe foure kinds?

Theſe, Addition, Subtraction, Multiplication, and Diuiſion.

Why is not Numeration alſo counted as a part?

Becauſe Numeration together with the figures and places whereof it conſiſteth, are counted rather as firſt Elements, and Principles of Arithmeticke, then as parts or ſpeciall kinds thereof.

Of Addition.

WHat is Addition?

It is that which teacheth to bring many ſeueuerall ſummes into one ſumme.

How is that done?

Firſt, by placing euery ſeuerall number one right vnder another, vnder which you muſt draw a Line: that done, you muſt adde together the numbers of the firſt ranke, beginning on the right hand with the loweſt figure of the ſame ranke, and ſo going vpward to the higheſt figure of the ſame ranke, and ſo from ranke to ranke, till you come to the laſt, and if the ſumme of any ranke doe not exceed the number of any of the foreſaid nine Digits, then ſet downe that Digit which comprehendeth that number right vnder his proper ranke, beneath the Line, but if the ſumme of that ranke exceedeth the number of any one Digit, by reaſon that it conſiſteth of Articles and digits, then ſet downe the digit, and keepe the article or articles in your minde, to bee added to the firſt figure of the next ranke of the left hand, but if the ſumme bee an euen Article or Articles, then ſet downe a Cypher, keeping the number of Article or Articles in your minde, bee it, one, two, or three, to bee added to the next ranke: all which things you ſhall better vnderſtand by this example heere following. As for Example, I ſpent in one yeare 125. l. in another yeare 234. l. and in another yeare 240. l. Now to know the totall ſumme of all this, I place theſe ſeuerall ſummes one right vnder another, and then I draw a Line vnder them as heere you ſee.

l.
125.
234.
240.
599.

Then beginning on the right hand with the loweſt Figure of the firſt ranke aboue the Line, I ſay that a Cypher and 4. is but 4. Againe, 4. and 5. maketh nine, which I ſet downe vnder the Line, then proceeding to the ſecond ranke towards the left hand, I ſay that 4. and 3. maketh 7. and 7. and 2. maketh 9. which alſo I ſet downe, then remouing to the third ranke, I ſay that 2. and 2. maketh 4. and 4. and 1.

maketh 5. which I alſo ſet downe as you ſee in the former example, ſo as the totall ſumme vnder the line is 599. l.

Another example hauing cyphers mixt with digits.

3047.
4508.
3049.
10/604.

Heere I ſay that 9. and 8. maketh 17. and 17. and 7. maketh 24. wherefore I ſet downe the digit 4. and keepe two Articles in mind, which being added to the loweſt figure of the ſecond ranke, which is 4. maketh 6. then 6. and 4. maketh 10. heere I ſet downe a cypher, keeping one article in minde, which beeing added to the figure 5. of the third ranke maketh 6. which I alſo ſet downe, then I ſay that 3. and 4. maketh 7. and 7. and 3. maketh 10. for the which I ſet downe firſt a cypher: and then becauſe there is no more to be added, I ſet downe on the left hand the one article which I had in mind, ſo as the whole ſumme commeth to 10/604. as in the former example.

How are pounds, ſhillings, pence, halfe-pence, and farthings, and all other numbers of diuers Denominations to be added?

You muſt diuide euery ſeueral name into diuers columnes or ſpaces by themſelues, and then beginning with the firſt on the right hand, you muſt adde euery columne by it ſelfe, bringing farthings to halfe-pence, and halfe-pence to pence, pence to ſhillings, and ſhillings to pounds, ſetting the ſumme of euery columne vnder the nether line, as you ſee in this example following.

l	s̄	d̄	ob.	q;
345	13	1	0	1
234	11	0	1	1
45	14	9	1	0
320	6	8	1	1
946	5	8	0	1

Heere firſt beginning with the columne of farthings, I find therein 3. farthings which is one half-peny and one farthing. Wherefore I ſet downe the odde farthing as you ſee, and keep the halfe-peny in mind: then adding the half-peny in minde to the loweſt halfe-peny of the ſecond columne, I ſay that 1. in minde and 1. maketh 2. and 2. and 1. maketh 3. then 3. and 1. maketh 4. which 4. halfe-pence, becauſe they make iuſt two pence, I ſet downe a cypher, keeping the two pence in mind, which two pence being added to 8. maketh 10. then 10. and 9. maketh 19. and 19. and 1. maketh 20. Now becauſe that 20. d. maketh 1. ſhilling and 8. d. I ſet downe the 8.d. keeping the ſhilling in mind, which 1. ſhilling being added to the 6. of the next columne, maketh 7. then 7. & 4. maketh a 11. and 11. and 1. maketh 12. then 12. and 3. maketh 15. wherfore I ſet downe 5. keeping the article in mind, which being added to 1. of the next columne, maketh 2. and 2. and 1. maketh 3. and 3. and 1. maketh 4. Articles, which 4. articles maketh 40. s. which is two pound, which I keepe in mind, and therefore I adde the 2. l. to the columne of pounds, ſaying that 2. and 5. maketh 7. and 7. and 4. maketh a 11. and a 11. and 5. maketh 16. wherefore I ſet downe 6. keeping the 1. article in mind, which being added to 2. of the next columne, maketh 3. then 3. and 4. maketh 7. and 7. and three maketh 10. then 10. and 4. maketh 14 wherefore I ſet downe 4. keeping one article in minde, which being added to 3. of the next columne, maketh 4. then 4. and 2. maketh 6. and 6 & 3. maketh 9. which I alſo ſet downe, ſo as the totall ſumme amounteth to 946. l. 5. s. 8. d. no halfe-peny, one farthing, as you ſee in the former example.

How ſhall I know whether theſe ſeuerall ſummes bee truely added or not?

Some doe teach it to bee done by culling out all the nines, which way is more tedious then ſure: for the ſureſt tryall indeed is to bee done by ſubtracting the ſeuerall ſummes out of the totall ſumme, of which ſubtraction we come now to ſpeak, for all the foure ſpeciall kinds are tryed one by another.

CHAP. III.

Of Subtraction.

What doth Subtraction teach?

It teacheth to take a leſſer number out of a greater, and to ſee what remayneth.

What is to be obſerued in this kind?

Firſt, you muſt ſet down your greater number aboue, and then the leſſer number right vnder the ſame. As for example, I haue lent to one 564. pound, and hee hath paid me thereof 57. pound. Here to know what remayneth, I firſt ſet downe the number lent, and vnder that the number paid, and then draw a line as you ſee in this manner.

Lent.	564. l.
Paid.	57. l.

Here beginning on the right hand, I firſt ſay, take 7. out of 4. that cannot bee wherefore I take one Article of the next figure or place of the lent number, which Article being added to 4. maketh 14. then I ſay take 7. out of 14. and there remayneth 7. which I ſet downe vnder the 4. then I adde that one Article which I borrowed, to the ſecond figure of the paid number which is 5. ſaying that 5. and 1. in mind maketh 6. then take 6. out of 6. and there remayneth nothing, wherefore I ſet downe a cypher vnder the 5. of the paid number, then I proceed to the third figure of the lent number, which is 5. and becauſe I finde nothing written vnder it, nor hauing in minde to take out of it, I ſay, take nothing out of 5. and there remayneth ſtill 5. ſo as the remainder is 507. pound, as you ſee in this example following.

Lent.	564. l.
Paid.	57.
Remain.	507.

How ſhall I know whether this bee right or not?

By adding the remainder and the number paid together, the ſumme whereof (if you haue done well) will be all one with the number lent, as in the former example, I firſt adde 7. and 7. together, and that maketh 14. wherefore according to the precepts of addition before taught, I ſet down 4. keeping the Article in mind, then I ſay, 1. in mind and 5. maketh 6. which I alſo ſet downe; then I ſay nothing and 5. is 5. which I ſet downe in the third place, which in all maketh 564. a number equall to the number lent, as you ſee here following.

Lent.	564. l.
Paid.	57.
Remaine.	507.
Proofe.	564.

You may perceiue by this, that if any figure of the paid number be greater then the figure ouer him, out of the which it is to bee ſubtracted, you muſt alwayes borrow one Article of his next fellow, to be added againe to him in his proper place. But you haue to note, that hauing to deale with numbers of diuers denominations, then in borrowing any number,

number, you muſt alwayes haue reſpect to the denomination or name of the thing from whence you borrow, as in borrowing from ſhillings you borrow 12. & not 10. from pounds you borrow not one article, but 2. articles which do make 20. s. but when the whole number is altogether of one ſelfe denomination, then you muſt alwayes borrow one article which is 10. to make vp your number that wanteth. As you ſhall more plainly perceiue by this example contayning numbers of diuers denominations, as of pounds, ſhillings and pence, halfe-pence and farthings. Suppoſe therefore that you haue lent to one 467. l. 13. s. 4 d. ob. q. and he hath paid you againe thereof, 89. l. 16. s. 9. d. ob. q. Heere hauing ſet downe the ſumme lent in ſeuerall columnes, according to their diuers names, and then the ſumme paid: right vnder the ſame draw a line as you ſee in this example following.

	l.	s.	d.	ob	q.
Lent.	467	13	4	1	1
Paid.	89	16	9	1	0
Remaine.	377	16	7	0	1

Heere beginning with the firſt columne on the right hand, I ſay take nothing out of one, and one ſtill remayneth, which I ſet downe, then proceeding to the next, I ſay take one out of one and nothing remayneth, wherefore I ſet down a cypher, then proceeding to the next columne, I ſay take 9. out of 4. that cannot be, wherefore I borrow a ſhilling of the next columne, that is, 12. d. which being added to 4. maketh 16. pence, then I ſay take 9. out of 16. and there remaineth 7. which I ſet downe, then proceeding to the next I adde the one ſhilling which I borrowed, to the 16. which maketh 17. then I ſay take 17. s. out of 13. s. that cannot bee, wherefore I borrow one pound which is two articles of the next ranke, that is, 20. s. which being added to the 13. s. maketh 33. s. then I ſay take 17. out of 33. s. and there remaineth 16. s. which I ſet downe; then I adde the one pound which I borrowed, to 9. and that maketh 10. then I ſay take 10. out of 7. that cannot be, wherefore I borrow one article out of the next 6. which being added to the 7. maketh 17. then I ſay take 10. out of 17. and there remayneth 7. which I ſet downe, then the 1. which I borrowed, I adde to the 8. of the next ranke, and that maketh 9.

Againe,

Againe, I ſay take 9. out of 6. that cannot bee: wherefore borrow one article of the next 4. which being added to 6. maketh 16. then I ſay take 9. out of 16. and there remaineth 7. which I ſet downe, then I take the one which I borrowed out of the 4. and there remayneth 3. ſo as the remainder is as you ſee in the former example 377. l. 16. s. 7 d. no ob. one q.

How ſhall I try whether this be true or not?

By adding the remainder and the ſumme paid together, as in the former example: and of that addition, will riſe, if you haue done truly, a ſumme like in euery condition to the ſumme lent. In making which proofe or tryall you cannot lightly erre, if you remember to reduce pence to ſhillings, and ſhillings to pounds, and therefore in the columne of pence, no particular ſumme can be aboue 11. d. nor in the columne of ſhillings no particular ſumme can bee aboue 19. s. for if it be 20. s. then it is a pound, and muſt be brought to the columne of pounds.

CHAP. IIII.

Of Multiplication.

WHat is Multiplication?

It is the producing or bringing forth of a third number, by multiplying two other numbers the one into the other: And it conſiſteth of three numbers, that is, the multiplicand, the multiplyer, and the product.

What ſignifie thoſe names?

The multiplicand is that number which is to be multiplied, and the multiplier is that whereby the ſame is multiplied, and the product is the ſumme of ſuch multiplication: As for example, if I would multiply 4. by 3. as in ſaying three times 4. maketh 12. heere the number of 4. is the multiplicand, and the number 3. is the multiplier, and the number 12. is the product of that multiplication.

What order is to bee obſerued in multiplying, and how are thoſe numbers to be ſet?

Before.

Before I teach you the true order of multiplying, I thinke it good to ſet you downe a Table of Multiplication, which vnleſſe you learne perfectly by heart, you ſhall neuer multiply readily nor quickly.

The firſt Table of Multiplication.

2	2	4	3	5	15	4	9	36	6	8	48	9	9	81
2	3	6	3	6	18	4	10	40	6	9	54	9	10	90
2	4	8	3	7	21	5	5	25	6	10	60	10	10	100
2	5	10	3	8	24	5	6	30	7	7	49			
2	6	12	3	9	27	5	7	35	7	8	56			
2	7	14	3	10	30	5	8	40	7	9	63			
2	8	16	4	4	16	5	9	45	7	10	70			
2	9	18	4	5	20	5	10	50	8	8	64			
2	10	20	4	6	24	6	6	36	8	9	72			
3	3	9	4	7	28	6	7	42	8	10	80			
3	4	13	4	8	32									

How is this Table to be read?.

In this manner: 2. times 2. maketh 4. and 2. times 3. maketh 6. and 2. times 4. maketh 8. and ſo forth multiplying ſtill one digit by another, vntill you come to 100. for this Table ſerueth only for digits, which may be made to extend ſo farre as you will, and vntill you haue learned the foreſaid Table without Booke, you may help your ſelfe with this other Table of digits, made ſquire wiſe as you ſee here:

1	2	3	4	5	6	7	8	9	0
1	2	3	4	5	6	7	8	9	1
	4	6	8	10	12	14	16	18	2
		9	12	15	18	21	24	27	3
			16	20	24	28	32	36	4
				25	30	35	40	45	5
					36	42	48	54	6
						49	56	53	7
							64	72	8
								81	9

In the Front of which Table are ſet downe the 9. Digits, beginning on the left hand, & ſo proceeding to the right hand, from 1. to 9. Againe on the right ſide of the ſaid table are ſet downe

the

the foreſaid 9. digits, beginning aboue and ſo proceeding right downe from 1. to 9. the vſe whereof is thus, firſt ſeeke the digit to be multiplyed in the front, and ſeeke the other whereby you haue to multiply the ſame on the right hand, & the ſquare Angle anſwering to theſe 2. digits, will ſhew the product of ſuch Multiplication. As for example, hauing to multiply 7. by 6. I firſt ſeek the greater digit which is 7. in the front, & the leſſer which is 6. on the right hand, the product whereof I find in the ſquare Angle anſwering both to 7. & to 6. to be 42. and the like is to be obſerued in any 2. digits that are of the like value, as 7. times 7. the product whereof is 49. But the firſt table being perfectly learned without booke, whenſoeuer you haue to multiply one nũber by another, you muſt obſerue theſe rules here following.

Firſt, that you ſet downe the firſt figure of your multiplyer right vnder the firſt figure of the number, that is to be multiplyed on the right hand, and then orderly to place the reſt of the figures of your multiplyer, be they few or many, towards your left hand, directly vnder the reſt of the figures of the number that is to be multiplied, for if the figures ſtand not in order one right euer another, it will breed a confuſion in your working. Secondly, you muſt not forget to multiply all the figures of the number that is to be multiplyed: by the firſt figure of your multiplier before you deale with the next multiplyer, beginning alwayes on your right hand, and ſo to proceed from one to another, whereby you ſhal make as many ſeuerall products as there be figures in your multiplier. Thirdly, you muſt remember to ſet downe the firſt figure of euery ſeueral product, right vnder the figure of that multiplyer, whereby you do multiply, and hauing ended your multiplication, draw a line vnder the ſeueral products: that done, adde the ſeueral products together according to ẏ rules of addition, & the ſum thereof ſhal be ẏ totall or generall product of that multiplication: all wᶜ rules you ſhal ẏ better vnderſtand by working this example following. Suppoſe thẽ that you would know how many houres there are in a yeere, knowing firſt ẏ a yeere cõſiſteth of 365. daies & 6. houres, here becauſe ẏ euery natural day cõtaineth 24. houres comprehẽding both day & night, you haue to multiply 365. by 24. & ther-

fore

fore you muſt firſt ſet down 365. becauſe it is the greater number, and is the multiplicand, which muſt alwayes ſtand aboue, and right vnder that, your multiplier which is 24. is to bee ſet downe in his due place, according to the rules before taught, thus, as you ſée here.

365.	the multiplicād
24.	The multiplyer.

Then ſay thus, 4. times 5. maketh 20. and hauing ſet downe a cypher right vnder the 4. kéep the 2. articles in mind, then ſay 4. times 6. is 24. and 2. in mind is 26. here ſet downe 6. and kéep 2. in mind, then ſay 4. times 3. is 12. which with the 2. in mind maketh 14. here firſt ſet downe the 4 vnder the 3. and becauſe you can procéed no further, you muſt therefore ſet downe hard by the 4. on the left hand the one article which you had in mind, then hauing cancelled the firſt figure of the multiplier, by making a daſh thorow it with your Pen, as you ſée in the example following: Procéed with the other figure of the multiplier, ſaying that two times fiue maketh 10. wherfore ſet downe a cypher right vnder the ſaid 2. kéeping the one article in mind, then ſay 2. times 6. is 12. and one in mind maketh 13. wherefore ſet downe 3. and kéepe one in mind, then ſay 2. times 3. is 6. which with one in mind maketh 7. yͤ which you muſt ſet down: and becauſe you haue made an end of your multiplication, cancell the 2. and draw another line vnder the 2. ſeuerall products; that done, adde together whatſoeuer is contained betwixt the two lines, and you ſhall find the general product to bee 8/760. houres, vnto which adding the odde 6. houres, the number of houres contayned in the whole yeare will be 8766. houres.

The multiplicand.	365.
The multiplier.	~~24~~
The ſeuerall	1460.
Products.	730.
The generall product or total ſum:	8760

How ſhal I know whether the laſt multiplication be right or not?

By diuiding the generall product by the multiplier, for in ſo doing your quotient will be like vnto the firſt ſumme that was multiplyed, which you cannot doe, vntill ſuch time as you haue learned to diuide, and therefore hauing firſt ſhewed certaine compendious wayes of multiplication, I will then procéed to diuiſion.

Certaine

Certaine compendious wayes of Multiplication.

WHen is any ſuch way to be vſed?

When the Multiplyer beginning on the right hand with one Cypher or with many, endeth on the left hand with the digit 1. as theſe Numbers following. 10/100/1000/ &c.

What is then to be done?

If you haue to multiply by 10. then you haue no more to do, but to ſet downe on the right hand of the number that is to bee multiplyed, one Cypher, if by a 100. then two Cyphers, if by a 1000. then 3. Cyphers, as for example: if you would multiply 365. by 10. then by ſetting downe on the right hand one Cypher, as hath beene ſaid, the product will bee 3/650. if you ſet downe two Cyphers, the product will be 36/500. if you ſet downe thrée Cyphers, then the product will be 365/200.

What if the number doe end on the left hand with any other Digit, as 2. 3. or more, as 200. 300. 400?

Then you muſt multiply the number of the multiplicand, firſt, by that digit, and then adde to the end of the product on the right hand all the Cyphers annexed to the ſaid digit, as if you would multiply 365. by 200. Firſt, ſay 2. times 5. maketh 10. and 2. 6. and 1. in mind is 13. and ſo to procéed in multiplying euery figure of the multiplicand by 2. and you ſhall finde the product to be 730. whereunto if you adde on the right hand 2. Cyphers, the whole product will be 73/000.

CHAP. V.

Of Diuiſion.

WHat is Diuiſion?

Diuiſion is that whereby any number is diuided into as many parts as you will.

How many numbers are incident to Diuiſion, and how are they called?

Theſe foure, that is to ſay, the number which is to bee diuided, which is called the Diuidend, the ſecond number

whereby

whereby you doe diuide, which is called the Diuiſor, the third number is called the quotient, which ſheweth how many times the Diuiſor is comprehended in the diuidend, and the fourth number is called the remainder, if any be.

What order is to be obſerued in Diuiſion?

This heere following; firſt ſet downe your diuidend, and directly vnder that, beginning on the left hand, ſet downe your Diuiſor, that is to ſay, the firſt figure of your Diuiſor right vnder the firſt figure of your diuidend on the left hand, and ſo conſequently one after another proceeding towards the right hand, which is alwayes to be done ſo often as your Diuiſor doth not exceed in quantity, the figure ſtanding right ouer his head: for if it doe, then you muſt remoue your Diuiſor one Figure further towards the right hand. As for Example; if you would diuide 487. by 53. you muſt not ſet the firſt Figure of your Diuiſor which is 5. vnder the firſt figure of your diuidend, which is but 4. but vnder the ſecond figure of your diuidend, which is 8. for you cannot take 53. out of 48. and therefore you muſt ſet the firſt figure of your Diuiſor, vnder the ſecond figure of the diuidend, and ſo follow on with the reſt, and then draw a Line, as you ſee heere in this Example following.

What is then to be done?

The diuidend. 487. (9. the quotient.
The Diuiſor. 53.

Then you muſt aſke how many times 5. is comprehended in 48. and you ſhall find that 5. is comprehended in 48. 9. times, which 9. being the quotient, muſt bee placed on your right hand, behind a crooked line made like a halfe Moone, as you ſee in the Example aboue, then multiply the firſt figure of the Diuiſor by the quotient 9. and the product thereof ſhall be 45. which beeing taken out of 48. there will remayne 3. which you muſt ſet downe ouer the head of 8. and ſtreeke out the 48. and alſo the firſt Figure of your Diuiſor which is 5. that done, multiply the ſecond figure of your Diuiſor which is 3. by the foreſaid quotient which is 9. and the product thereof will be 27. which beeing taken out of 37. there remayneth 10. which you muſt ſet ouer the head of 37. and cancell the 37. and alſo the three beneath, as you ſee in this Example following.

Wherein

1 the remainder
~~3~~0
The Diuidend. ~~487~~ (9. the quotient.
The Diuiſor. ~~53~~

Wherein you ſee that the diuidend is 487. the Diuiſor 53. the quotient 9. and the remainder 10. which if you will apply to any vſe, you may imagine that there is 487. l. to be diuided amongſt 53. Souldiers, and by working as before, you ſhall find that euery Souldier muſt haue nine l. and there ſhall be remayning ten l. to bee diuided amongſt the foreſaid 53. Souldiers, which ten l. being reduced to ſhillings, may be diuided amongſt the Souldiers, as well as the pounds: As for Example, if you multiply 10 l. by 20. s. it will make 200. s. which being diuided by 53. the firſt Diuiſor, the quotient will be 3. s. and the remainder 41. s. and that being reduced into pence, which is done by multiplying 41. by 12. the quotient will bee 9. d. and the remainder 15. d. which if you multiply by 4. you ſhall reduce them to farthings, the product whereof will be 60. which product being diuided by 53. the firſt Diuiſor, you ſhall find in the quotient one farthing, and the remainder to be $\frac{7}{53}$ of a farthing, the value of which Fraction how to find out is taught hereafter when we come to ſpeake of Fractions. So as you ſee by this meanes that euery Souldier ſhall haue for his ſhare 9. l. 3. s. 9. d. q; and ſomewhat more; a thing of no moment.

How many things are to be remembred in Diuiſion?

These fiue Rules heere following. Firſt, that you put no number at one time in the quotient aboue 9. Secondly, to moderate your quotient in ſuch ſort, as hauing multiplyed the firſt figure of the Diuiſor by the quotient, there may remayne ſufficient for the next figure of the Diuiſor being multiplied by the quotient, to bee deduced out of that number which ſtandeth right ouer his head. Thirdly, that you multiply euery figure contayned in the Diuiſor by the quotient. Fourthly, that if at any time in working it happeneth ſo as your Diuiſor is not comprehended in the number ouer his head, then to put a Cypher in the quotient, and to remoue your Diuiſor one figure further towards the right hand, and that done to worke as before. Fifthly, to ſee that the laſt remainder, if there be any left, doe

not

not exceed in quantitie the Diuiſor, all which things you ſhall better vnderſtand by this one Example following: Suppoſe then that you haue to diuide 819096. by 92. heere hauing ſet downe your Diuidend and Diuiſor in ſuch order as is before taught, and as you ſee heere in this Example.

8
$\cancel{9}3$
The diuidend. $\cancel{8}\cancel{1}\cancel{9}096$ (8. the quotient.
The diuiſor. $\cancel{9}\cancel{2}$

Firſt, aſke how many times 9. is in 81. and you ſhal find the quotient to be 8. which being multiplyed into 9. maketh 72. which if you make out of 81. there ſhall remayne 9. which muſt bee ſet downe ouer the head of figure 1. and cancell the ſaid 81. together with the firſt figure of the Diuiſor, which is 9. then ſay two times eight is ſixteene, which being ſubtracted out of 99. there remayneth 83. which you muſt ſet ouer the head of the 99. and cancell the 99. that is aboue, and alſo the 2. beneath, as you ſee in the former Example. That done remooue your Diuiſor towards the right hand, that is to ſay, by ſetting the laſt figure of your Diuiſor which is 2. vnder the next cypher on the right hand, & place the firſt figure of your Diuiſor which is 9. next to that towards the left hand: then aſke how many times 9. is comprehended in 83. and you ſhall finde 9. times, which 9. muſt bee ſet downe in the quotient next to the 8. then ſay 9. times 9. is 81. which beeing taken out of 83. there remayneth 2. then hauing ſet downe the 2. ouer the head of 3. cancell the 83. aboue and alſo the 9. beneath, then multiply the laſt figure of the Diuiſor which is 2. by the 9. which is in the quotient, and the product thereof is 18. which beeing taken out of 20. there remayneth 2. which 2. muſt bee ſet downe ouer the Cypher, and the Cypher cancelled, and alſo the 2. beneath, as you ſee in this Example following.

$\cancel{2}$
$\cancel{8}\cancel{3}2$
The diuidend. $\cancel{8}\cancel{1}\cancel{9}\cancel{0}96$ (89.
The diuiſor. $\cancel{9}\cancel{2}$

That done remooue your Diuiſor one Figure further towards the right hand by ſetting the 2. vnder the 9. which is the laſt figure ſaue one of the diuidend, & place the firſt figure of your diuiſor which is 9. next to that on the left hand, then aſke how many times 9. is contayned in 2. and you ſhall find none, wherefore you muſt ſet downe a cypher in the quotient, and cancell the diuiſor, as you ſee in this example.

2
The diuidend. $\cancel{8}\cancel{1}\cancel{9}\cancel{0}96$ (890.
The diuiſor. $\cancel{9}\cancel{2}$

That done remoue your diuiſor againe by ſetting the 2. vnder the laſt figure of the diuidend, & place the 9. next to that on the left hand, then aſke how many times 9. is contayned in 29 and you ſhall find 3. times, which 3. you muſt ſet downe in the quotient, as you ſee in the example following, then multiply the firſt figure of your diuiſor which is 9. by 3. and the product thereof will be 27. which being taken out of 29 there will remayne 2. which 2. you muſt ſet ouer the head of 9. and cancell the 9. aboue, together with the 9. beneath, then multiply the 3. which is in the quotient by the laſt figure of your diuiſor which is 2. and the product thereof will be 6. which being taken out of 29. there remayneth 20. wherefore you muſt ſet downe a cypher ouer the 6. which is the laſt figure of the diuidend, and cancell the ſaid 6. aboue, and alſo the 2. beneath, and then you haue done rightly, and in ſuch order as all the former examples, and this alſo next following doe plainly ſhew.

the remaynder.
$\cancel{2}$ 20. |20.
The diuidend. $\cancel{8}\cancel{1}\cancel{9}\cancel{0}\cancel{9}\cancel{6}$ (8903|92.
The diuiſor. $\cancel{9}\cancel{2}$ the quotient.

For heere you ſee that the diuidend is 819|096. the diuiſor 92. the quotient 8903. & the remaynder 20. which remaynder muſt bee ſet on the right hand of the quotient ouer the diuiſor, hauing a line drawne betwixt them as you ſee in the laſt example.

How ſhall I know whether I haue diuided truely or not?

By multiplying the quotient by your diuiſor, and by adding to the product thereof the remaynder, for ſo ſhall you haue a number like to the firſt diuidend if you haue wrought wel, if not, then your ſumme will be either more or leſſe then the diuidend.

Certaine compendious wayes of Diuiſion.

IS there no ſhorter way of Diuiſion?

No, vnleſſe the Diuiſor hath one cypher or more on the right hand, for then you may vſe a briefer way by cutting off the laſt figure, or figures of the diuidend: As for example, if you had to diuide 3708. by 10. heere cut off the laſt figure 8. with a daſh of your Pen in this wiſe, 370/8. and the quotient will be 370. and the remainder ſhall be 8. Againe, if you had to diuide the foreſaid number by 100. then cut off the two laſt figures of the diuidend, that is, the 8. and the cypher ſtanding next it, and then the quotient will bee but 37. and the remainder 8. as before, but if you haue to diuide any number by 1000. then you muſt cut off three figures of the diuidend, and ſo forth, remembring alwayes for euery cypher in the Diuiſor, to cut off one figure or cypher of the diuidend.

Of halfing any Number.

HOw is that done?

By diuiding the number by 2. As for example, if you would know the halfe of 3708. diuide the ſame by 2. and you ſhall find the quatient to be 1854. which is the iuſt one halfe of the diuidend.

CHAP. VI.

Of the Rule of three, otherwiſe called the golden Rule, whereof there be three kinds, that is, the common Rule, the Rule Reuerſe, and the Double Rule.

WHerefore is it called the Rule of Three.

Becauſe that by three knowne numbers it teacheth you to finde out a fourth number vnknowne.

How are ſuch three numbers to be placed?

The firſt is to bee placed on the left hand, the third on the right hand, and the ſecond in the middeſt betweene both.

How ſhall I know in what place each one is to be ſet?

By marking to what number the queſtion is annexed, for that muſt alwayes be the third number, and hauing the third number, you ſhall quickly haue the firſt, becauſe the firſt and third muſt alwayes bee of one ſelfe-denomination or name, betweene which two, the ſecond number is to bee placed: As for example, let this bee the queſtion. If I pay 35. s̃. for 13. yards of linnen cloath, how much ſhall I pay for three yards? heere becauſe the queſtion is annexed to the number 3. yards, that muſt be the third number, and is to be placed on the right hand, then becauſe that the number 13. yards is of the ſelfeſame denomination, that muſt be the firſt number, and is to be placed on the left hand, and the number 35. s̃. (which is the price) is to be placed in the middeſt betwixt the other two, as you ſee heere following.

Now muſt you make your queſtion in this maner, if 13. yards did coſt me 35 s̃. what ſhal three yards coſt me? and ſo the firſt and laſt ſhall bee of one denomination or name, that is to ſay, yards.

yards.	s̃.	yards.
13.	35.	3.

What order is to be obſerued in working by this Rule?

You muſt multiply the third and ſecond numbers the one into the other, and diuide the product thereof by the firſt, and the quotient will ſhew you what the fourth number ſhould be, which fourth number is alwayes of like denomination to the ſecond or middle number, as in the former example: firſt multiply 35. by 3. and the product will be 105. which if you diuide by 13. the quotient will be eight ſhillings and one third of a ſhilling which is foure pence, and that is the price of thrée yards which is the number that you ſéeke to know. And this is the common kind of working by the rule of thrée, whereof it is called the common Rule of thrée.

What if there be diuers denominations either of coyne, as of pounds, ſhillings and pence, or parts of yards, as quarters, halfe-quarters, and ſuch like?

Then you muſt reduce them to all the ſmalleſt denomination which belongeth to Fractions, whereof wee come now to treate.

CHAP. VII.

Of Fractions.

WHat are Fractions?

They are broken parts of ſome whole thing called in Latine Integrum.

What is Integrum?

Any thing that is whole, and not broken, or diuided into parts: as one whole yard, a pound, a ſhilling.

Of how many numbers doth a Fraction conſiſt?

Of two, that is, the Numerator, and the Denominator, whereof the numerator is alwayes ſet aboue, and the denominator beneath, hauing a little line drawne betwixt them thus $\frac{1}{2}$ which ſignifieth one ſecond or one halfe, againe, two thirds and thrée fourths are written thus $\frac{2}{3}\frac{3}{4}$ whereof the firſt ſignifieth two thirds, and the other thrée fourthes and ſuch like.

What

What is meant by theſe two words, Numerator and Denominator, and whereto ſerue they?

The denominator is as much to ſay as the manner of the parts, which ſheweth into how many parts the integrum is to be diuided, and the numerator is as much to ſay as the numberer, and ſheweth how many of thoſe parts are to bee taken: As for example, $\frac{2}{3}$ of a ſhilling; here the nethermoſt called the denominator, ſheweth that the ſhilling is to be deuided into thrée parts, as into thrée groats, and the vpper number called the numerator, ſheweth that you muſt take 2. out of thoſe 3. parts, ſo as $\frac{2}{3}$ of a ſhilling is as much to ſay, as two groats or 8.d. Againe, fractions may be diuided into two kinds, that is, into ſimple fractions, and into fractions of fractions.

Define thoſe two kindes.

Simple fractions are ſuch as I ſpake of before, which are the firſt and immediate parts of any integrum that is diuided into parts, but if thoſe fractions be diuided into more fractions, then are they called fractions of fractions, as when I ſay thrée fourthes of two thirds, of ſix ſeuenths and ſuch like.

How are ſuch fractions to be ſet downe in writing?

In manner of ſimple fractions thus, $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{6}{7}$.

Make ſome demonſtration of this example, that I may the better vnderſtand it?

Imagine that there is a whole péece of gold of 7.s̄. as our angell in times paſt hath béene, which 7 s̄. be the ſeuen parts of that péece of gold, for tryall whereof lay downe before you 7. twelue-peny péeces of ſiluer, or in ſtead thereof 7. counters, to ſignifie thoſe ſeuen parts, of which ſeuen parts you muſt firſt take away ſix, reiecting or laying aſide the odde ſeuenth part, then diuide thoſe 6. parts into thrée parts, and euery ſuch part will be iuſt 2.s̄. of which 3. parts you muſt take away 2. parts, that is, 4.s̄. reiecting the other third part, which remaineth, that done, diuide thoſe 2. parts which you haue taken away into 4. parts, which is 4.s̄. & take 3. of them, reiecting the fourth part, ſo ſhall you find that $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{6}{7}$ of the foreſaid péece of gold is iuſt 3.s̄. & there remaineth ſtill of the parts reiected 4.s̄. which being added to 3. that was taken away, doe make vp againe

the

the whole integrum of 7.s Notwithſtanding fraction of fractions doe ſeldome chance in the diuiſion of any number, but if they doe, you muſt reduce them into ſimple fractions, before you can deale with them any manner of way, and becauſe there are diuers rules belonging to fractions, without the knowledge whereof you can neyther adde, nor ſubtract them, nor yet ioyne them with any integrum, I wil briefly ſet downe héere ſeuen neceſſary rules for the ſame.

Seuen neceſſarie rules belonging to Fractions.

What doth the firſt rule teach?

To bring Fractions of Fracions into ſimple Fractions.

How is that done?

Thus; multiply the firſt numerator into the ſecond, and if there bee any more fractions, then multiply alſo the ſaid product of the firſt two numerators into the third numerator, and that ſhall be the numerator of the ſimple fraction, then multiply the denominators in like manner, and the ſumme thereof ſhal be the denominator of the ſimple fraction, as in the former example $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{6}{7}$, héere I multiply the firſt two numerators together, in ſaying two times thrée maketh ſix, now becauſe I haue a third numerator, I multiply the product of the firſt two numerators, which is 6. into the third numerator which is alſo 6. ſaying ſix times ſix maketh 36. and that ſhall bee the numerator of the ſimple fraction, which I ſet downe. Then by multiplying the thrée denominators in like manner, I find the denominator of the ſimple fraction to bee 84. the which I ſet downe vnder the 36. and draw a line betwixt them, ſo as now I find that $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{6}{7}$ doe make $\frac{36}{84}$ which indeed is no more but $\frac{3}{7}$ as you ſhall learne hereafter by the ſixt rule.

What doth the ſecond rule teach?

To bring fractions being more in value then integrums into integrums.

When are fractions ſaid to be more then integrums?

When the numerator is a greater number then the denominator, for if they bee both of like value as $\frac{14}{14}$ and ſuch like, then ſuch fraction is an euen integrum.

How ſhall I know how many integrums ſuch fractions as be more then integrums doe contayne?

By diuiding the numerator by the denominator, and if any thing remayne, write that aboue the denominator, as in this example $\frac{806}{7}$ héere if you diuide 806. by 7. which is the denominator, you ſhal find the quotient to contayn 115. integrums, and the remainder to be 1. which is $\frac{1}{7}$.

What doth the third rule teach?

To bring integrums into parts by multiplying the number of the integrums by the denominator of thoſe parts, as if you would bring 64. yards into quarters, multiply 64. by 4. and there will ariſe thereof 256. quarters.

What doth the fourth Rule teach?

It teacheth to bring integrums hauing fractions annexed to them, into one fraction.

How is that done?

Multiply the number of the integrums by the denominator of the fraction annexed, and then adde to the product the Numerator of the ſaid fraction, and that ſumme ſhall bee the Numerator, vnder which write the denominator aforeſaid, and ſo you ſhall find that 23. integrums hauing $\frac{2}{3}$ annexed thereunto ſhall make $\frac{71}{3}$.

What doth the fift rule teach?

It teacheth to expreſſe a fraction written with many Figures, in ſo few as may be.

How ſhall I doe that?

Thus; find out ſome number that may firſt diuide the Numerator, and then the denominator ſeuerally by themſelues, without leauing in either of them any remainder, and the quotient of the firſt diuiſion wil ſhew the Numerator, and the quotient of the ſecond diuiſion will ſhew the denominator, but if you cannot readily find out a number that will diuide them both without leauing ſome remaynder, then leaue not to ſubtract the leſſer number out of the greater, vntill you find two like numbers, by one of the which 2. like numbers diuide ỹ Numerator,

merator, and alſo the denominator ſeuerally as before, and the quotient will ſhew that which you ſeeke, but if ſuch two like numbers cannot be found, then you may aſſure your ſelfe, that the fraction cannot bee written in fewer figures then they alreadie be.

Giue example of theſe two wayes?

For example of the firſt way, ſuppoſe that you would expreſſe $\frac{9}{12}$ in leſſer numbers, heere ſeeke out ſome number that may diuide euenly both the numerator, and alſo the denominator, without leauing in either of them any remainder, which by diuiding each of them by the number of 3. you may do: For by aſking how many times 3. is contayned in 9. the quotient will be 3. and in aſking how many times 3. is contayned in 12. the quotient ſhall be 4. ſo ſhall you find $\frac{9}{12}$ to bee no more then $\frac{3}{4}$. Now for example of the ſecond way, let $\frac{27}{81}$ be yͤ fraction which you would ſet downe in fewer figures, heere becauſe you cannot readily find out a number that will euenly diuide both the numerator and the denominator, ſubtract the leſſer out of the greater, that is to ſay 27. out of 81. and there will ſtill remayne 54. from which ſubtract 27. and there will remayne 27. which two numbers becauſe they are both like, diuide the numerator and denominator of the foreſaid fraction, each of them by one of theſe numbers, that is to ſay, by 27. and the quotient of the firſt diuiſion will ſhew you the numerator which is 1. and the quotient of the ſecond diuiſion will ſhew you the denominator which is 3. ſo as you ſhall find $\frac{1}{3}$ to bee as much in value as $\frac{27}{81}$ and note that when there bee cyphers both in the numerator and the denominator ſtanding in ſuch ſort as they may be euenly cut off, the remainder will ſhew the feweſt figures, wherein the fraction may bee written as $\frac{200}{500}$ heere by cutting off the two cyphers as well beneath as aboue the line, with a daſh of your pen in this manner $\frac{2}{5}/\frac{00}{00}$ the remainder ſhall bee $\frac{2}{5}$ which is as much in value as $\frac{200}{500}$. And fractions may bee ſet downe in minimis, that is to ſay, in the leaſt numbers more readily by diuiſion, then by ſubtraction in this manner: firſt diuide the greater number by the leſſer, and if there bee no remainder left, then by the remainder diuide the laſt diuiſor

that

that went next before, continuing ſtill ſo to doe, vntill you find ſuch a number as will euenly diuide the laſt diuiſor, without leauing any remainder, for that number will diuide both the numerator and alſo the denominator of the giuen fraction, without leauing any remainder. As for example, ſuppoſe the giuen fraction, to be $\frac{36}{15}$ which you would ſet downe in minimis or ſmalleſt numbers: heere hauing diuided 39. by 15. you finde the remainder to bee 6. by which 6. you haue to diuide againe the laſt diuiſor which is 15. and you ſhall finde the remainder to be 3. which doth euenly diuide 6. without leauing any remainder at all. Wherefore you may boldly ſay that 3. is the common diuiſor, as well to the numerator as to the denominator of the giuen fraction, for if you diuide 36. by 3. you ſhall find in the quotient 12. which ſhall bee the numerator of the new found fraction, and by diuiding the denominator of the giuen fraction, which is 15. by 3. you ſhall haue in the quotient 5. and that ſhall bee the denominator of the new found fraction, ſo ſhall the new found fraction be $\frac{12}{5}$ which is in value as much as the giuen fraction $\frac{36}{15}$. And you haue to note that ſuch numbers as may be euenly diuided by another number without leauing any remainder, are called compounds. But ſuch as cannot bee diuided but that there will remayne ſome odde vnite, thoſe are called Primes. You haue alſo to vnderſtand that if the giuen fraction be ſuch as the greater number thereof may at the firſt be euenly diuided by the leſſer number, without leauing any remainder, then the quotient of that firſt diuiſion ſhall bee the common diuiſor. As for example, let $\frac{27}{81}$ bee the giuen fraction, as it was in the firſt example that was to bee wrought by ſubtraction, heere by diuiding the greater number by the leſſer, you ſhall find no remainder but onely 3. in the quotient, which is the common diuiſor, for if you diuide the numerator of the giuen fraction 27. by 3. the numerator of the new found fraction will bee 9. and hauing diuided the denominator of the giuen fraction which is 81. by 3. the denominator of the new found fraction will bee 27. which is no more in value but $\frac{1}{3}$ for if you diuide 9. by 3. the quotient will bee 3. and if you diuide 27. by 3.

the

the quotient will be 9. againe, by diuiding 9. by 3. the quotient will be 3. then aſke how many times 3. is contayned in 3. and there will be but 1. and by aſking how many times 3. is contayned in 9. you ſhall find 3. ſo as the new fraction ſhall bee $\frac{1}{3}$ and thus you ſee that $\frac{9}{27}$ or $\frac{3}{9}$ is either of them but $\frac{1}{3}$ and that the number 3. which was the firſt quotient, is the common diuiſor as well to the Numerator as to the denominator of the firſt giuen fraction. And looke as compound fractions may bee ſet downe in minimis by diuiſion, ſo may compound proportions be ſet downe in minimis by like manner of diuiſion, as ſhall be declared hereafter when we come to ſpeake of proportions.

What doth the ſixth rule teach?

It teacheth to find out the value of the fraction of any integrum.

How is that done?

Thus; multiply the Numerator by the knowne parts of the integrum, and diuide the product thereof by the denominator, ſo ſhal you haue the value of the fraction: As for example; if you would know the value of $\frac{3}{4}$ of an angell, conſider firſt what parts an angell hath, and you ſhall find the parts thereof to be 10. ſ. or 30. groates, heere if you multiply 3. by 10. ſ. it will make 30. ſ. which being diuided by 4. you ſhall find in the quotient 7. ſ. & the remaynder to be $\frac{2}{4}$ or one half of a ſhilling, which is 6. d. Againe, if you multiply 3. by 30. groates, it will make 90 groates, which being diuided by 4. you ſhall find in the quotient 22. groates, and the remaynder to bee $\frac{2}{4}$ or one halfe of a groat which is 2. pence, making in all 7. ſ. 6. d. like vnto the firſt ſumme, ſo as you ſee that $\frac{3}{4}$ of an angell is 7. ſ. 6. d. and thus you may deale with the fractions of any other integrum that hath knowne parts.

What doth the ſeuenth Rule teach?

It teacheth to bring fractions of diuers denominations to one ſelfe-denomination, without the which neither addition, nor ſubtraction of fractions can be made: As for example, if you would adde $\frac{2}{3}$ and $\frac{4}{5}$ together, you muſt firſt bring them to one ſelfe-denomination thus: multiply the denominators the one into the other, and the product thereof ſhall bee a common denominator to both the fractions, wherefore ſay 3. times 5. do make 15. which muſt bee ſet downe in two ſeuerall places by themſelues thus, 15. and 15. then multiply the Numerator of the firſt fraction into the denominator of the ſecond, as 2. into 5. maketh 10. which ſet downe ouer the firſt common denominator thus $\frac{10}{15}$ then multiply the Numerator of the ſecond fraction into the denominator of the firſt fraction as 4. into 3. which maketh 12. and that muſt bee likewiſe ſet downe ouer the ſecond common denominator thus $\frac{12}{15}$ ſo ſhall you finde that $\frac{2}{3}$ and $\frac{4}{5}$ are all one in value with $\frac{10}{15}$ and $\frac{12}{15}$.

CHAP. VIII.

Additions of Fractions.

HOw are fractions to be added together?

Fractions being firſt brought to one denomination are eaſily added, for then you haue no more to do but adde the Numerators together, and to write the common denominator vnder the ſumme of ſuch addition, as in the former example $\frac{10}{15}$ being added to $\frac{12}{15}$ maketh $\frac{22}{15}$ but if the denominators be not like, then you muſt make them like by the ſeuenth rule before taught.

What if there bee three fractions of diuers denominations to be added together, as $\frac{2}{3}\frac{3}{4}\frac{4}{5}$.

Then hauing reduced the two firſt to one ſelfe-denomination, adde the two Numerators together, and write vnder the ſumme thereof the common denominator, that done, deale with that fraction laſt found, and with the third as you did before with the two fractions that had diuers denominations and ſo you ſhall find that $\frac{2}{3}$ and $\frac{3}{4}$ being firſt brought to one denomination, and then added together doe make $\frac{17}{12}$ whereto if you will adde $\frac{4}{5}$ then you muſt bring them againe to one ſelfe denomination, and ſo you ſhall find that $\frac{17}{12}$ and $\frac{4}{5}$ doe make $\frac{85}{60}$ and $\frac{48}{60}$ which laſt two Numerators being added together do make in all

all $\frac{153}{60}$, which is two integrums and $\frac{33}{60}$, but a more ready way is to multiply all the denominators together into one totall or common denominator, and then for the ſeuerall numerators multiply each numerator by all the denominators, ſauing that which is vnder it ſelfe, and ſo is the former queſtion performed as one worke or any ſuch like how many ſoeuer.

Subtraction of Fractions.

HOw are Fractions to be ſubtracted one out of another, or out of Integrums?

Firſt, make the denominators like as you did before in Addition, then take the leſſer numerator out of the greater, and vnder the remainder thereof write the common denominator, ſo ſhall you find that $\frac{2}{7}$ being taken out of $\frac{5}{7}$ there remayneth $\frac{3}{7}$, but if you would ſubtract Fractions out of Integrums, then you muſt take one of the Integrums and breake it into parts. As for example, to ſubtract $\frac{3}{7}$ out of 9. Integrums take one from 9. and breake it into parts making it $\frac{7}{7}$ for that is one Integrum, for whenſoeuer the numerator is made like and equal, to the denominator, it ſignifieth one Integrum, then take $\frac{3}{7}$ out of $\frac{7}{7}$ and there remayneth $\frac{4}{7}$ and 8. Integrums.

What is to be obſerued in breaking the Integrum?

In breaking the Integrum, you are to be directed alwayes by the denominator of the Fraction which you haue to ſubtract, for the Integrum which ſhould be the numerator, muſt be equall in value to the ſaid denominator, as before is ſaid.

Multiplication of Fractions.

HOw are Fractions to be multiplied by Fractions, or Integrums by Fractions?

As touching fractions, multiply the numerator one into another, and the product therof ſhalbe the numerator, then multiply the denominators in like manner, and the product thereof ſhall be the denominator, ſo ſhall you find that $\frac{5}{7}$ being multiplied by $\frac{3}{4}$ do make $\frac{15}{28}$. But if you wold multiply Integrums by fractions, then multiply the integrums by the Numerator of the fraction, and vnder the product thereof ſet downe the denominator of the ſame fraction, drawing a line betwixt them, ſo ſhall you find that 20. integrums being multiplyed by $\frac{5}{12}$ do make $\frac{100}{12}$ that is to ſay eight integrums and $\frac{4}{12}$ which is $\frac{1}{3}$, &c.

Diuiſion of Fractions.

HOw are fractions to be diuided by fractions, or integrums by fractions, or fractions by integrums?

The diuiſion of fractions is done by Multiplication thus, firſt ſet downe your diuidend on the left hand, and the Diuiſor alwayes on the right hand, and then draw two croſſe lines like a Saint Andrewes Croſſe betwixt them which ſhall direct you in your working: As for example, if you would diuide $\frac{2}{3}$ by $\frac{4}{5}$ ſet them downe thus;

Diuidend. Diuiſor.

$\frac{2}{3} \quad \times \quad \frac{4}{5}$ and worke as followeth: firſt multiply the numerator of the diuidend, by the denominator of the diuiſor, and the product thereof ſhall be the numerator, then multiply the denominator of the diuidend by the numerator of the diuiſor, and that ſhal be the denominator ſo ſhall you finde that $\frac{2}{3}$ being diuided by $\frac{4}{5}$ the quotient is $\frac{10}{12}$ or $\frac{5}{6}$, but if you would diuide integrums by fractions, or contrariwiſe fractions by integrums, then make of integrums a fraction, by ſetting downe 1. in the place of a denominator vnder the integrums, and worke as before, ſo ſhall you find that $\frac{7}{1}$ integrums being diuided by $\frac{3}{4}$ do make $\frac{28}{3}$ contrarily if you diuide $\frac{3}{4}$ by $\frac{7}{1}$ integrums, there will ariſe $\frac{3}{28}$.

What if I haue to diuide fractions annexed to integrums?

Then you muſt firſt reduce each integrum with his fraction annexed, into one ſelfe-fraction by the fourth rule of fractions before taught. As for example, if you would diuide nine integrums hauing $\frac{3}{4}$ thereunto annexed, by three integrums and $\frac{1}{3}$, heere the fourth rule of fractions teacheth you firſt to multiply the integrum 9. by 4. which is the denominator of the

the fraction annexed, the product whereof is 36. whereunto by adding the numerator of the ſame fraction which is 3. you ſhall make the numerator of the diuidend to be 39. vnder which you muſt ſet the denominator 4. thus; $\frac{39}{4}$ and that is your whole diuidend, then hauing in like maner brought the diuiſor which is 3. integrums and $\frac{1}{3}$ into one ſelfe-fraction, worke as the former Rule of Diuiſion teacheth you, and you ſhall produce $\frac{117}{40}$ which is two integrums and $\frac{37}{40}$.

Chap. IX.

The Rule of three belonging to Fractions.

WHat order is to bee obſerued in this Rule hauing to deale with Fractions onely?

The ſelfe-ſame order that hath béene taught before touching integrums: for in working with fractions you muſt haue alſo thrée ſeuerall numbers, and you muſt ſée that the firſt and third numbers be of one ſelfe-denomination, and that number is to be placed alwayes in the third place whereunto the queſtion is annexed, and then to multiply the ſecond by the third, and ſo diuide by the firſt, and ſo the fourth number which you ſéeke to know, ſhall appeare: As for example, if $\frac{3}{4}$ of an ell of fine Holland coſt me $\frac{2}{3}$ of an Engliſh Crowne, in value 15. groats, what ſhall $\frac{5}{6}$ of an ell coſt me? héere firſt you muſt ſet downe your thrée ſeueral numbers in order thus; $\frac{3}{4}$ ell $\frac{2}{3}$. $\frac{5}{6}$ ell ſo as the firſt and third may be one ſelfe-denomination: then multiply the ſecond and third fraction the one into the other, which will make $\frac{10}{18}$ and that being diuided by $\frac{3}{4}$ which is in the firſt fraction, will produce $\frac{40}{54}$ of a crowne, the value of which fraction if you ſéeke to know by helpe of the ſixt rule of fractions, teaching you to multiply the numerator of the fraction, by the knowne parts of a crowne, which are fiue ſhillings or fifteene groats, you ſhall find the value of that fraction to be eleauen groates and $\frac{6}{54}$ of a groate,

which

which is one farthing and ſomewhat more, ſuppoſing the leaſt knowne parts of a Groat to be ſixtéene Farthings.

Chap. X.

The golden Rule reuerſe, called in Latine Regula reuerſa, *that is to ſay, turned backward.*

WHat is the order of this Rule?

Multiply the firſt by the ſecond, and diuide the product thereof by the third, as if a peny-loafe muſt weigh two pound, Wheate being at thrée ſhillings a buſhell, what ſhall a peny loafe weigh when wheat is at two ſhillings the buſhell? the queſtion muſt bee framed thus, if thrée ſhillings require two pound weight, what ſhall two ſhillings haue? then by working according to this Rule, you ſhall find that the peny loafe muſt weigh thrée pound.

Another example of the ſame Rule.

I Would know how many yardes of Bayes bearing in breadth $\frac{7}{4}$ will ſuffice to line ſeuen yards of ſilke bearing in breadth thrée quarters and a halfe. Héere you muſt frame your queſtion thus, if $\frac{3}{4}$ and $\frac{1}{2}$ require ſeuen yards, what ſhall $\frac{7}{4}$ require? but becauſe the firſt and third number of this queſtion are not of one ſelfe-denomination by reaſon of the fraction annexed to the firſt number, you ſhall doe well to reduce the firſt and third number both into halfe quarters, and then to worke as though they were all integrums, which is more eaſie then to make all the numbers fractions; wherefore ſay thus: If ſeuen halfe quarters doe require ſeuen yards, what ſhall fourtéene halfe quarters require? and in working by the Rule Reuerſe, you ſhall find in the quotient thrée yards of Bayes and a halfe.

Chap.

Chap. XI.

The double Rule called in Latine Regula duplex.

WHereto ſerues this Rule? and what order is to be obſerued therein?

This Rule ſerueth to vnfold two queſtions wrapt in one, as thus. If I pay 4.d. for the carriage of 20.l. waight 30. miles, what ſhall I pay for the carriage of 50.l. waight 60. miles? here of this and ſuch like demands, you muſt make two ſundry queſtions, and the fourth ſumme of the firſt queſtion being found, ſhall be the ſecond or middle number of the ſecond queſtion, wherefore frame your firſt queſtion thus, if 20.l. coſt 4.d. what ſhall 50.l. coſt? and you ſhall find that it will coſt you 10.d. then ſay if 30. miles coſt 10.d. what ſhall 60. miles coſt? and you ſhall find that it will coſt 20.d. And note that each of theſe two queſtions is to be wrought by the common Rule of three, that is to ſay, by multiplying the ſecond into the third, and by diuiding the product thereof by the firſt, and the fourth found number of the firſt queſtion muſt be the ſecond, or middle number of the ſecond queſtion, as in the former example, you ſee that 10.d. which was the fourth found number, is here the middle number of the ſecond queſtion.

Another Example.

IF 25. pound do gaine me eight pound in foure yeares, how much ſhall 100. pound winne one in ten yeares? both theſe queſtions are alſo to be wrought by the common Rule of three. Wherefore ſet downe the firſt queſtion thus: if 25. pound yeeldeth eight pound, what ſhall 100. yeeld? and you ſhall find 32. pound: then ſay foure yeares yeeldeth 32 pound, what ſhall ten yeares yeeld? and you ſhall find eighty pound. But note that theſe double queſtions may bee put in ſuch ſort as you muſt worke the firſt or ſecond queſtion, ſometimes by the Rule reuerſe. As in this Queſtion héere following, if 6.l. winne eight Crownes in ten yeares, in how many yeares ſhall 3.l. win 12. Crownes? héere frame your firſt queſtion thus: if 6.l. require ten yeares, how many yeares ſhall 3.l. require? and in working this Queſtion by the Rule Reuerſe, you ſhall find twentie yeares, then for the ſecond Queſtion ſay thus, if eight Crownes require twenty yeares, how many yeares ſhall 12. Crownes require? héere if you worke by the common Rule of Thrée, you ſhall find thirty yeares.

Another Example.

IF ſeuen horſes do eat 12. buſhels of Oats in twenty dayes, how many buſhels ſhal fourtéene horſes eat in fiftéene dales? héere frame your firſt queſtion thus, If ſeuen horſes eat twelue buſhels, what will fouretéene horſes eate? and in working by the common Rule of Thrée, you ſhall find in the quotient 24 buſhels, then frame your queſtion thus, if 20. dayes require 24. buſhels, what ſhall fiftéene dayes requre? héere in working by the common Rule of Thrée, you ſhall find in the quotient eightéene buſhels.

Another Example.

IF ten Reapers reape fiftéene Acres in ſeuen dayes, in how many dayes ſhall ſixtéene Reapers reape twenty Acres? héere frame your firſt Queſtion thus, if ten Reapers require ſeuen dayes, how many dayes ſhall ſixtéene Reapers require? which Queſtion muſt be wrought by the Rule Reuerſe, & ſo you ſhall find foure dayes and $\frac{3}{8}$ of a day which is nine houres, then ſay, if fiftéene Acres require foure dayes and $\frac{3}{8}$ of a day, how many dayes ſhall twentie Acres require? and in working this ſecond Queſtion by the common Rule of Thrée, belonging to Fractions, as is before taught, you ſhall finde that twentie Acres will require fiue dayes and $\frac{20}{24}$ of a day, which is twentie houres. But it were more eaſie in this ſecond Queſtion to reduce the dayes into houres, by multiplying the foure dayes by 24. houres, the product whereof will be 96. houres, whereunto if you adde the odde nine houres, it will make in all 105.

houres, which being multiplyed by the third number of this ſecond queſtion, which is 20. the product ſhall be 2100. houres, which diuided by the firſt number of the ſaid queſtion which is 15. you ſhall find in the quotient 140. houres, which if you diuide againe by 24. you ſhall find in the quotient 5. dayes, and the remaynder to bee 20. houres, which agréeth in all points with the firſt manner of working by fractions, and is the eaſier way of the two.

How ſhall I know, hauing to worke by this double Rule, when to vſe the Rule Reuerſe?

By conſidering whether the third Number requireth more or leſſe of time, or of any other meaſure or quantitie, as in the former Example, of Bayes for lining, the more breadth it had, the leſſe did ſerue for lining. Againe, in the Example of gaine by yeares, of 6.l. and 3.l. you did ſée that 3.l. require more yeares then 6.l. and therefore that firſt Queſtion was wrought by the Rule Reuerſe: Alſo in this laſt Example of the Reapers, the more Reapers the leſſe time they require, and therefore that queſtion was wrought by the Rule Reuerſe.

CHAP. XII.

The Rule of Fellowſhip.

WHat doth this Rule teach?

To know the gaine or loſſe of ſuch as doe make a ſtocke, and doe occupie together in the Trade of Merchandize: As for Example, foure Merchants did put their money in lot in this manner. The firſt brought thirtie Crownes, the ſecond fiftie, the third ſixtie, and the fourth an hundred, and with theſe portions they gained 3000. Crownes, the queſtion is how much euery one ſhall haue to his ſhare of that gaine, according to the portion which he brought. To know this, you muſt firſt gather all the ſeuerall portions together by Addition into one Summe, and you ſhall finde the Summe of the portions to bée 240. Crownes, then ſay if 240. Crownes do gaine 3000. Crownes, what ſhall thirtie gaine, and after this manner worke by the common Rule of thrée, with all the reſt of the portions, and ſo you ſhall find that he which brought thirty ought to haue 375. Crownes, & he that brought fifty ought to haue 625. Crownes, and he that brough ſixty ought to haue 750. Crownes, and hee that brought an hundred ought to haue 1250. which maketh in all 3000. Crownes, for that is the very ſumme of the gaine before ſet downe, the order of working whereof, this figure plainly ſheweth.

240	3000	30	375.
		50	625.
		60	750.
		100	1250.

The common Diuiſor which is the ſum of the particular portions added together.	the generall gaine.	the particular portiōs.	euerymans ſingle ſhare

A like Example of loſſe receiued by Shipwracke.

THrée Merchants doe venture their goods in one ſhip, the goods of the firſt were worth 300. Crownes, the ſecond 400. the third 500. there were as much goods caſt out as was worth 100. Crownes the Queſtion is how much euery one ſhould loſe according to his portion, hére worke as before, and you ſhall find that euery one ſhall loſe ſo much as this Figure following ſheweth.

1200	100	300	25.
		400	33.$\frac{1}{3}$ which is fiue groats.
		500	41.$\frac{2}{3}$ which is ten groats.

The common Diuiſor which is the ſum of the particular portions added together.	the generall loſſe.	the particular portiōs.	euery mans ſeueral loſſe.

Hére to know whether the thrée ſeuerall loſſes doe make vp the generall loſſe, doe thus, firſt adde the Integrums of the ſeuerall loſſes together, the ſumme whereof will bee 99. whereunto if you adde the two fractions which do make one whole crown, the ſumme will be 100. a number like vnto the generall loſſe.

Another Example.

Thrée Merchants haue bought 1000. ℓ. of Pepper for thrée hundred Crownes, the firſt taketh 200. ℓ. the ſecond 350. ℓ. and the third 450. ℓ. what ſhall euery man pay according to the portion which he hath receiued, then ſay if 1000. ℓ. bee worth 300. Crownes, what is 200. ℓ. worth? hére working by the common Rule of Thrée with euery mans ſeuerall portion receiued, you ſhall find that the firſt muſt pay 600. Crownes, the ſecond 105. and the third 135. Crownes, as this figure hére following ſheweth.

	ℓ		
1000	300	200 350 450	60. 105. 135
The common Diuiſor	the generall price.	the ſeuerall portions receiued.	euery mans particular paymont.

Another like Example of diuers diſtance of time.

Thrée Merchants occupying together did gaine 2345. Crownes, the firſt put in fortie Crownes for the ſpace of fourtéene months, the ſecond put in fifty Crownes for the ſpace of eight months, & the third put in 85. Crownes for the ſpace of ſix months: the queſtion is, how much euery one ſhall haue after the rate of his money, and according to the quantitie of time? This is to be wrought according to the Rule of Fellowſhip thus, multiply euery mans money by his time, eyther of which, that is to ſay, the money and the time muſt bee of one ſelfe denomination, then adde the Summes of thoſe ſeuerall portions together and the totall ſumme of ſuch Addition ſhall be the firſt number, and the common gaine ſhall bee the ſecond number, and the third number ſhall bee euery mans money multiplyed by his time, then in working by the common Rule of thrée, you ſhall find that euery man ſhall haue ſuch ſhare as this figure here following ſheweth.

1470	2345	560 400 510	893. $\frac{1}{3}$ 638. $\frac{2}{21}$ 813. $\frac{4}{7}$
The common Diuiſor which is the totall ſumme of the ſeuerall portions of money and time added together.	the generall ſumme of the gaine.	the particular portions of the money multiplied by his time	euerie mans ſingle ſhare.

Now if you would know whether the ſingle ſhares in this example, do make vp the generall ſumme of the gaine, then adde together the integrums or whole ſummes of euery mans ſingle ſhare, and you ſhall find the ſumme to bee but 2344. which wanteth one whole integrum of the ſecond or middle number of the queſtion, which you ſhall eaſily ſupply by adding the thrée ſeuerall fractions together according to the rule of Addition of fractions before taught, for ſo ſhall you find the ſaid thrée fractions to make in all one whole integrum, which being added to 2344. will be anſwerable to the ſecond number of the Queſtion, which as you ſée in the Example is 2345. And remember in adding together the ſaid thrée fractions, to ſet them in this order $\frac{1}{3}/\frac{2}{21}/\frac{4}{7}$. and then to bring them to one ſelfe-denomination, as the ſeauenth Rule of fractions teacheth you. But firſt becauſe you ſhall finde the thrée remainders after the firſt thrée Diuiſions of the thrée ſeuerall portions made by the firſt common Diuiſor of the Queſtion to bee written in many figures, you muſt ſet them downe in fewer figures, according as the fifth Rule of fraction teacheth you, ſo ſhall you finde the firſt remainder contayning $\frac{490}{1470}$ to bee no more but $\frac{1}{3}$ and the ſecond remainder contayning $\frac{140}{1470}$ to bee $\frac{2}{21}$ and the third remaynder contaynig $\frac{840}{1470}$ to bee $\frac{4}{7}$, which thrée fractions being added together according to the ſeuenth Rule of fractions, which will $\frac{147}{147}$ which is one whole integrum, and muſt be added by the name of 1. to the middle or ſecond number of the queſtion as I haue ſaid before: you may alſo make vp the foreſaid number by ſeeking to know the value of euery fraction annexed to the integrums, according as the ſixt Rule of fractions teacheth, for ſo ſhall you find the value of the firſt fraction to be fiue groats, and the value of the ſecond fraction to bee one groat ſix farthings, and $\frac{18}{21}$ of a farthing, and you ſhall finde the value of the third fraction to be eight groats, nine farthings, and $\frac{1}{7}$ of a farthing, and if you adde $\frac{18}{21}$ and $\frac{1}{7}$ of a farthing together, you ſhall finde that it will make $\frac{147}{147}$ which is one whole integrum or one whole farthing. Now, if you adde ſix, nine and one farthings together, it will make in all ſixteene farthings, and that is one groat, which being added to the fourteene groates before found out, will make in all fifteene groates, which is one crowne, and that being added to the ſumme 2344. will make it 2345. crownes, which is a number agreeable to the middle ſumme of the queſtion. Truly if you exerciſe your ſelfe in this and ſuch like queſtions, it wil make you perfect not only in Addition, Subtraction, Multiplication, and Diuiſion of whole numbers, but alſo of fractions, and almoſt in all the other rules belonging as well to fractions, as to integrums. Wherefore I would wiſh you often to vſe your pen therein.

Hauing hitherto treated of the foure ſpeciall kinds of Arithmeticke, that is, of Addition, Subtraction, Multiplication and Diuiſion, as well belonging to whole numbers, as to fractions: and alſo ſhewed the vſe of the Golden Rule, otherwiſe called the Rule of Three, & of all the three kinds thereof, that is, the common Rule, the Rule Reuerſe, and the Double Rule, and giuen Examples, how and when euery one is to be vſed, together with the Rule of Fellowſhip, neceſſarie for them that vſe any trade of Merchandize, I thinke good now to ſpeake ſomewhat of Arithmeticall and Geometricall progreſſion, and alſo of proportion, and of the three kinds thereof, that is, Arithmeticall, Geometricall, and Muſicall porportion, and then of the extraction of Roots both ſquare and cubicall, and laſt of all, of Aſtronomicall fractions, ſhewing how they are to bee added, ſubtracted, multiplyed and diuided.

CHAP. XIII.

Of Progreſſion, and how manifold it is.

WHat is Progreſſion?

It is a certaine order, of proceeding with diuers Numbers in ſuch ſort, as euery one may exceed each other, either by like difference of quantitie, or elſe by likeneſſe of Proportion, whereof ſpringeth two kinds of Progreſſion, the one called Arithmeticall, and the other Geometricall.

What is Arithmeticall Progreſſion?

It is that which proceedeth by like difference of quantitie, as thus; 3.5.7.9.11.13. whereof euery one exceedeth his fellow by the difference of two.

What is Progreſſion Geometricall?

It is that wherein euery number exceedeth his fellow by like Proportion, for as ſixe contayneth three twiſe, ſo doth twelue contayne ſix twiſe, &c.

CHAP. XIIII.

Of Addition belonging to Progreſſion Arithmeticall.

HOw are Numbers being ſet in order according to Progreſſion Arithmeticall, to be added together, and to be reduced into one totall ſumme?

Thus, firſt ſee how many ſeuerall numbers there be in all, and note the ſumme by it ſelfe, then adde the firſt number of the Progreſſion to ý laſt therof, & note that ſum by it ſelfe, that done, multiply one of theſe two reſerued ſums by the one halfe of ý other, and you ſhall haue the totall ſumme. As for Example, let theſe be your Progreſſion. 6.10.14/18/22/26/30/34/ wherein euery number exceedeth his fellow by the difference of foure: here hauing told the numbers. I finde them to be eight, which I ſet downe by it ſelfe, then I adde 6. which is the firſt number to 34. which is the laſt, and the ſumme thereof is 40. which I alſo ſet downe by it ſelfe, then in multiplying 40. by 4. which is the one halfe of 8. before ſet downe apart by it ſelfe, I find the totall ſumme of the Progreſſion to be 160.

CHAP. XV.

Of Addition belonging to Progreſſion Geometricall.

HOw are numbers being ſet in order according to Progreſſion Geometricall to be added and to be brought into one ſumme?

Thus multiply the laſt ſumme of the Progreſſion by the number of the Proportion, whereby ſuch progreſſion proceedeth, and from the product of that multiplication, ſubtract the firſt number of the progreſſion: that done, diuide that which remayneth by a number which is leſſe then the proportion by one, and the quotient of ſuch diuiſion ſhall ſhew you the totall ſumme of the ſaid progreſſion. As for Example, let this be the progreſſion, 2:6.18.54.162.486.1458. the proportion of which progreſſion is triple, wherefore according to the rrle, I multiply the laſt number of the progreſſion by 3. and the product of ſuch multiplication amounteth to 4/374. out of which ſumme I ſubtract the firſt number which is 2, and there remayneth 4372. which I diuide by 2. (for it is leſſe then the proportion 3. by 1.) and ſo I find in the quotient 2186. which is the totall ſumme of the progreſſion Geometricall.

Is there no briefer way of adding ſuch kinds of progreſſion?

Yes indeed, but not ſo plaine as this way is, and therefore I thinke not good to trouble your memorie therewith.

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CHAP. XVI.

Of Proportion.

WHat is proportion ?

Proportion is taken generally for the comparing of two diuers quantities or numbers together, ſhewing what likeneſſe is betwixt them. But before wee deale with Proportion, and with the three kindes thereof, that is, Proportion Arithmeticall, Geometricall, and Muſicall: You haue firſt to vnderſtand, that of numbers ſome are ſaid to be abſtract, and ſome concrete.

The abſtract are ſuch as are not tyed to any denomination, and ſuch as are two-fold, that is abſolute and relatiue.

The abſolute are ſimply pronounced without hauing any relation to any other number, meaſure or quantitie, as 2.3.4. &c. and all numbers whatſoeuer, that are without denomination, and are not attributed to any other thing.

The relatiue are thoſe which haue relation one to another, which may be three manner of wayes. Firſt, in reſpect of difference which is found by ſubtraction: ſecondly, in reſpect of the quotient found by diuiſion: thirdly, in reſpect of both. Of the firſt way ſpringeth Arithmeticall proportion: Of the ſecond way Geometricall Proportion: And of the third Muſicall Proportion.

CHAP. XVII.

WHat is Arithmeticall Proportion ?

Arithmeticall Proportion, vnproperly ſo called, (becauſe it is no Proportion indeed) is when many ſeuerall numbers haue one ſelfe and like difference, as 8.12.16. which doe only differ one from another by 4. and this Proportion is two-fold, that is, continuall and diſiunct.

Con-

Continuall is, when any numbers proceed with like difference, as hath béen ſaid before when we ſpake of Arithmeticall progreſſion, as 8. 12. 16. 20. &c. whoſe difference betwixt euery two numbers is foure.

The Diſiunct, is when many numbers being ſeuerally propounded, the difference of the firſt two numbers is not like to the difference that is betwixt the ſecond and the third, and ſo forth, as 5. 8. 4. 7. for 8. differeth from 5. by 3. and 4. from 8. by 4. and 7. from 4. by 3. Now of the ſecond way of comparing, which is done by diuiſion, ſpringeth as hath béene ſaid before, Geometricall proportion.

CHAP. XVIII.

What is Geometricall proportion?

Geometricall proportion, is that which ſheweth what part or parts one number is off another number, as thrée is the halfe of ſixe, which proportion is found by diuiſion, wherein you haue to note, that if the diuiſor be greater than the diuidend, then it is to be made a fraction, as in the former example: if you would diuide thrée by ſixe, then you muſt make it a fraction thus, $\frac{3}{6}$ or $\frac{1}{2}$, and this kind of proportion, which may be truly and properly called a proportion indéede, or rather a proportionalitie, is ſaid to be two-fold, that is, direct, and reuerſe, and the direct is either Coniunct, or Diſiunct.

Coniunct differeth not from Geometricall Progreſſion, before taught.

Diſiunct proportion Geometricall, conſiſting moſt commonly of foure numbers, or of thrée at the leaſt, is when there is not like proportion betwixt the ſecond and the third, that is, betwixt the firſt and the ſecond, or betwixt the third and the fourth, as 3. 6. 4. 8. for here ſixe containeth foure once, and one halfe thereof, which is called Proportio Seſquialtera, and ſixe containeth thrée twice, which is called Proportio dupla: and ſo is eight to foure.

CHAP. XIX.

Againe, proportion Reuerſe differeth not from the rule of Thrée, called Regula reuerſa. But you haue to vnderſtand, that the two chiefe and ſpeciall kinds of Geometricall proportion, are theſe, that is, proportion of equalitie, and proportion of inequalitie.

Proportion of equalitie, is when two numbers compared together, are equall the one to the other, as 3. to 3. 4. to 4.

The proportion of inequalitie, is when two vnequall numbers are compared together, as 6. to 5. 4. to 9. and of this there are two kindes, that is, proportion of the greater inequalitie, and proportion of the leſſer inequalitie.

CHAP. XX.

Proportion of the greater inequalitie, is when the greater number is compared to the leſſer number, as ſixe to fiue.

Proportion of the leſſer inequalitie, is when the leſſer is compared to the greater, as fiue to ſixe.

Of proportion of the greater inequalitie there be two kinds, Simplex *and* Multiplex, *that is to ſay, ſimple and manifold.*

Simplex, is when the Antecedent, that is to ſay, the former number containeth the conſequent, that is to ſay, the latter number once and ſomewhat more, which ouerplus muſt alwayes be leſſe then the conſequent it ſelfe, as fiue containeth foure once and one part thereof more, for if you diuide fiue by foure, the quotient will be 1. and $\frac{1}{4}$ ouer. Againe, this proportion is two-fold, that is, Superparticular, and Superpartient, Superparticular, is when the Antecedent contayneth the conſequent once and ſome one part thereof, as 3. to 2. for 3. contayneth 2. once and one halfe thereof, which is called Seſquialtera, or as 4. to 3. for 4. contayneth 3. once and one third part thereof, and is called Seſquitertia, the like is to be ſaid of Seſquiquarta, Seſquiquinta, Seſquiſexta, and ſo forth infinitely, as this Table ſheweth.

Superparticular proportions are theſe & ſuch like.	Seſquialtera, as 3. to 2. 6. to 4. 9. to 6.	which is as much as	$1\frac{1}{2}$
	Seſquitertia, as 4. to 3. 8. to 6. 12. to 9.		$1\frac{1}{3}$
	Seſquiquarta, as 5. to 4. 10. to 8. 15. to 12.		$1\frac{1}{4}$
	Seſquiquinta, as 6. to 5. 12. to 10. 18. to 15.		$1\frac{1}{5}$
	Seſquiſexta, as 7. to 8. 14. to 12. 21. to 18.		$1\frac{1}{6}$
	Seſquiſeptima, as 8. to 7. 16. to 14. 24. to 21		$1\frac{1}{7}$
	Seſquioctaua, as 9. to 8. 18. to 16. 27. to 24.		$1\frac{1}{8}$
	Seſquinona, as 10. to 9. 20. to 18. 39. to 27.		$1\frac{1}{9}$
	Seſquidecima, as 11. to 10. 22. to 20. 33. to 30		$1\frac{1}{10}$
	Seſquiundeci. as 12. to 11. 24. to 22. 36. to 33		$1\frac{1}{11}$
	Seſquiduode. as 13. to 12. 26. to 24. 39. to 36		$1\frac{1}{12}$

But ſuperpartient is when the Antecedent contayneth the conſequent once and ſome parts thereof, that is to ſay, more parts then one, as fiue to thrée, for fiue contayneth thrée once and two third parts thereof, which is called Superbipartiens tertias, of which kindes are theſe ſet downe in the Table following.

CHAP.

Proportions ſuperpartient are theſe, and ſuch like.	Superbipartiens.	Tertias, as 5. to 3. 10. to 6. 15. to 9.	which is as much as	$1\frac{2}{3}$
		Quintas, as 7. to 5. 14. to 10. 21. to 15.		$1\frac{2}{5}$
		Septimas, as 9. to 7. 18. to 14. 27. to 21.		$1\frac{2}{7}$
		Nonas, as 11. to 9. 22. to 18. 33. to 27.		$1\frac{2}{9}$
		Vndecimas, as 13. to 11. 26. to 22. 39. to 33.		$1\frac{2}{11}$
		Decim. tertias, as 15. to 13. 30. to 26. 45. to 39.		$1\frac{2}{13}$
	Supertripartiens.	Quartas, as 7. to 4. 14. to 8. 21. to 12.	which is as much as	$1\frac{3}{4}$
		Quintas, as 8. to 5. 16. to 10. 24. to 15.		$1\frac{3}{5}$
		Septimas, as 10. to 7. 20. to 14. 30. to 21.		$1\frac{3}{7}$
		Octauas, as 11. to 8. 22. to 6. 33. to 24.		$1\frac{3}{8}$
		Decimas, as 13. to 10. 26. to 20. 39. to 30.		$1\frac{3}{10}$
		Vndecimas, as 14. to 11. 28. to 22. 24. to 33.		$1\frac{3}{11}$
	Superquadripartiens.	Quintas, as 9. to 5. 18. to 10. 27. to 15.	which is as much as	$1\frac{4}{5}$
		Septimas, as 11. to 7. 22. to 14. 33. to 21.		$1\frac{4}{7}$
		Nonas, as 13. to 9. 26. to 18. 39. to 27.		$1\frac{4}{9}$
		Vndecimas, as 15. to 11. 30. to 22. 45. to 33.		$1\frac{4}{11}$
		Decim. tertias, as 17. to 13. 34. to 26. 51. to 39.		$1\frac{4}{13}$
		Decim. quintas, as 19. to 15. 38. to 30. 57. to 45.		$1\frac{4}{15}$
	Superquintupartiens.	Sextas, as 11. to 6. 22. to 12. 33. to 18.	which is as much as	$1\frac{5}{6}$
		Septimas, as 12. to 7. 24. to 14. 36. to 21.		$1\frac{5}{7}$
		Octauas, as 13. to 8. 26. to 16. 39. to 24.		$1\frac{5}{8}$
		Nonas, as 14. to 9. 28. to 18. 42. to 27.		$1\frac{5}{9}$
		Vndecimas, as 16. to 11. 32. to 22. 48. to 33.		$1\frac{5}{11}$
		Duodecimas, as 17. to 12. 34. to 24. 51. to 36.		$1\frac{5}{12}$
	Superſextupartiens.	Septimas, as 13. to 7. 26. to 14. 39. to 21.	which is as much as	$1\frac{6}{7}$
		Vndecimas, as 17. to 11. 34. to 22. 51. to 33.		$1\frac{6}{11}$
		Decim. tertias, as 19. to 13. 38. to 26. 57. to 39.		$1\frac{6}{13}$
		Decim. ſeptim. as 23. to 17. 46. to 34. 60. to 51.		$1\frac{6}{17}$
		Decim. nonas, as 25. to 19. 50. to 38. 75. to 57.		$1\frac{6}{19}$
		Viceſſimas tertias, as 29. to 23. 58. to 46.		$1\frac{6}{23}$

Hitherto of Simplex proportio. Now of Multiplex proportio.

Multiplex proportio is, when the Antecedent containeth the Conſequent more then once, as 6. to 2. for 6. containeth 2. thrée times,

times, which is called Tripla proportio. Alſo 12. to 5. for 12. comprehendeth 5. twice and $\frac{2}{5}$. And this Multiplex proportio is two-fold, that is, either exact or not exact.

Multiplex exact, is when the Antecedent containeth the Conſequent more then once, and nothing remaineth, as 4. to 2. 6. to 3. &c. whereof are infinite kinds, as Dupla, Tripla, and ſo forth, as this Table ſheweth.

The kinds of Multiplex exact, are theſe & ſuch like.	Dupla,	as 4. to 2.	6. to 3.	8. to 4.	which is as much as	$\frac{2}{1}$
	Tripla,	as 6. to 2.	9. to 3.	12. to 4.		$\frac{3}{1}$
	Quadrupla,	as 8. to 2.	12. to 3.	16. to 4.		$\frac{4}{1}$
	Quintupla,	as 10. to 2.	15. to 3.	20. to 4.		$\frac{5}{1}$
	Sextupla,	as 12. to 2.	18. to 3.	24. to 4.		$\frac{6}{1}$
	Septupla,	as 14. to 2.	21. to 3.	56. to 8.		$\frac{7}{1}$
	Octupla,	as 16. to 2.	24. to 3.	32. to 4.		$\frac{8}{1}$
	Nondupla,	as 18. to 2.	27. to 3.	36. to 4.		$\frac{9}{1}$
	Decupla,	as 20. to 2.	30. to 3.	40. to 4.		$\frac{10}{1}$
	Vndecupla,	as 22. to 2.	33. to 3.	495. to 45.		$\frac{11}{1}$

But Multiplex not exact, is when the Antecedent containeth the Conſequent more then once, & ſomething remaineth ouer, as 5. to 2. for 5. containeth 2. twice, and one remaineth: and this is alſo two-fold, that is, Multiplex ſuperparticularis, and Multiplex ſuperpartiens.

Multiplex ſuperparticularis, is when the Antecedent containeth the Conſequent more then once, and one onely remaineth, as 7. to 3. for 7. containeth 3. twice, and one onely remaineth, whereof are diuers kinds, as Duplex ſeſquialtera, Duplex ſeſquitertia, Triplex ſeſquiſexta, and ſo forth, as the Table hereafter following ſheweth.

But Multiplex ſuperpartiens, is when the Antecedent containeth the Conſequent more then once, & the remainder is more then 1. as 8. to 3. for 8. containeth 3. twice, and 2. thirds ouer, whereof there be many kinds, as Dupla ſuperbipartiens tertias, Dupla ſupertripartiens quartas, and ſo forth, as this Table following ſheweth; which comprehendeth both kindes, that is, Multiplex ſuperparticularis, and Multiplex ſuperpartiens.

Multiplex

Multiplex not exact, is either

Multiplex Superparticularis or elſe	Duplex.	Seſquialtera,	as 5. to 2.	15. to 6.	which is	$2\frac{1}{2}$
		Seſquitertia,	as 7. to 3.	21. to 9.		$2\frac{1}{3}$
		Seſquiquinta,	as 11. to 5.	22. to 10.		$2\frac{1}{5}$
	Triplex.	Seſquiſexta,	as 19. to 6.	38. to 12.		$3\frac{1}{6}$
		Seſquiſeptima,	as 22. to 7.	44. to 14.		$3\frac{1}{7}$
		Seſquioctaua,	as 25. to 8.	50. to 16.		$3\frac{1}{8}$
	Quadruplex.	Seſquinona,	as 37. to 9.	148. to 36.		$4\frac{1}{9}$
		Seſquidecima,	as 41. to 10.	82. to 20.		$4\frac{1}{10}$
		Seſquiundecima,	as 45. to 11.	90. to 22.		$4\frac{1}{11}$

Multiplex Superpartiens.	Dupla.	Superbipartiens.	Tertias,	as 8. to 3.	which is	$2\frac{2}{3}$
			Quintas,	as 21. to 5.		$2\frac{2}{5}$
		Supertripartiens.	Quartas,	as 11. to 4.		$2\frac{3}{4}$
			Quintas,	as 13. to 5.		$2\frac{3}{5}$
		Superquadripartiens.	Quintas,	as 14. to 5.		$2\frac{4}{5}$
			Septimas,	as 18. to 7.		$2\frac{4}{7}$
	Tripla.	Superquintupartiens.	Octauas,	as 29. to 8.		$3\frac{5}{8}$
			Nonas,	as 34. to 9.		$3\frac{5}{9}$
		Superſextupartiens.	Vndecimas,	as 39. to 11.		$3\frac{6}{11}$
			Decim. tertias,	as 45. to 13		$3\frac{6}{13}$
		Superſeptupartiens.	Octauas,	as 31. to 8.		$3\frac{7}{8}$
			Nonas,	as 34. to 9.		$3\frac{7}{9}$
	Quadrupla.	Superbipartiens.	Tertias,	as 14. to 3.		$4\frac{2}{3}$
			Quintas,	as 22. to 5.		$4\frac{2}{5}$
		Superquadripartiens.	Quintas,	as 24. to 5.		$4\frac{4}{5}$
			Nonas,	as 40. to 9.		$4\frac{4}{9}$
		Superquintupartiens.	Sextas,	as 29. to 6.		$4\frac{5}{6}$
			Septimas,	as 33. to 7.		$4\frac{5}{7}$

Thus

Thus much of proportion of the greater inequalitie: Now we will ſpeake ſomewhat of Proportion of the leſſer inequalitie.

CHAP. XXI.

PRoportion of the leſſer inequalitie, is when the Antecedent is leſſe then the Conſequent, as 2. to 3: 5. to 7. for if you diuide 2. by 3. the quotient is $\frac{2}{3}$. if 5. by 7. then the quotient is $\frac{5}{7}$. and this proportion hath the ſame names which the proportion of the greater inequalitie hath, ſauing that you muſt adde to the beginning of euery name this word Sub, as Subdupla, Subtripla, Subſeſquialtera, &c. as 1. to 2. is Subdupla proportio, 3. to 9. is Subtripla proportio, &c.

CHAP. XXII.

Of Muſicall Proportion, called in Latine Harmoniaca proportio.

MUſicall proportion, which requireth thrée numbers at the leaſt, is when the firſt number hath the ſame proportion vnto the third, which the difference betwixt the firſt and the ſecond hath to the difference which is betwixt the ſecond and the third, as 3. 4. and 6. for looke what proportion 3. hath to 6. which is Subdupla, the ſame hath the difference betwixt 3. and 4. which is 1. to the difference betwixt 4. and 6. which is 2. for 1. to 2. is Subdupla, and this is called Muſicall proportion, becauſe the numbers therein haue the ſame proportions one to another, which are found to be in Muſicall Conſorts, as 6. 4. and 3. for the proportion which 6. hath to 4. is Seſquialtera, called of the Muſicians Diapente, or a fifth, and the proportion which 4. hath to 3. is Seſquitertia, called

of

of the Muſitians Diateſſeron, or a fourth, and the Proportion which 6. hath to 3. is Dupla, called a Diapaſon, or an Eight, & of this Muſicall Proportion there be two kinds, that is, ſimple and compound.

It is ſaid to be ſimple when it conſiſteth only of thrée Numbers.

And it is called compound when it conſiſteth of more then thrée Numbers: And of compound there bée two kinds, that is, vnproper and proper.

The vnproper is, when to 3. Numbers giuen, 2. other ſeuerall Numbers are ioyned, which do containe the ſame Proportions with the third, which the firſt 3. Numbers, haue one to another: As for Example, let be giuen theſe 3. Numbers, 3. 4. 6. vnto which if you ioyne 8. and 12. here 6. 8. 12. haue the ſame Proportion one to another, which 3. 4. and 6. haue amongſt themſelues; for like as here betwixt 6. and 8. the Proportinn is Subſeſquitertia, and betwixt 6. and 12. it is Subdupla, and betwixt 8. and 12. it is Subſeſquialtera, ſo betwixt 3. and 4. is Subſeſquitertia, and betwixt 3. and 6. is Subdupla, and betwixt 4. and 6. is Subſeſquialtera.

Compound proper, is, when diuers Numbers in Muſicall Proportion ſtanding together, and the firſt being omitted, the 3. next doe continue ſtill in Muſicall Proportion. Alſo when omitting the 2. firſt Numbers, the 3. next following are in Muſicall Proportion. And when omitting the firſt 3. the next 3. are in Muſicall Proportion, and ſo forth; how many Numbers ſoeuer there be: As for Example, 10. 12. 15. 20. 30. theſe are Numbers belonging to the proper kind of compound Muſicall Proportion, for 10. 12. and 15. are in Muſicall Proportion, then omitting 10. which is the firſt Number 12. 15. and 20. are ſtill in Muſicall Proportion, and if you omit the 2. firſt Numbers, that is, 10. and 12. then the next 3. that is 15. 20. and 30. are ſtill in Muſicall Proportion, and ſo forth, how many ſoeuer there be of them, ſo as they be in Muſicall Proportion: But our Muſitians doe make no more but 8. Muſicall Proportions in all, that is.

Dupla.	which are thus named.	Diapaſon.
Tripla.		Diapaſon diapente.
Quadrupla.		Bis diapaſon.
Seſquialtera.		Diapente.
Seſquitertia.		Diateſſeron.
Seſquiquarta.		Diatonus ſemitonus.
Dupla ſuperbipartiens.		Diapaſon diateſſeron.
Seſquioctaua.		Tonus.

The vſe whereof is to bee learned at the hands of the Muſitians.

CHAP. XXIII.

But now becauſe it is not enough to know the foreſaid Proportions and their names, vnleſſe you can both adde, ſubtract, multiply, and diuide them when need is, I will therefore briefly here ſet downe the order thereof, and firſt ſhew how to ſet them downe in Writing, and then how they are to be added, ſubtracted, multiplyed and diuided.

They are to be ſet downe in writing, in like manner that Fractions are wont to be ſet downe, ſauing that as in Fractions the vpper number is called Numerator, and the inferior number Denominator; ſo in Proportions the vpper number is called Antecedent, and the inferiour number Conſequent, but whereas in Fractions, there is wont to be drawne a little line betwixt the Numerator and the Denominator, in Proportions no line is drawne betwixt the Antecedent and the Conſequent, but the Antecedent is ſet ouer the Conſequent, without any line drawne betwixt them, thus.

And looke as Fractions are to bee written in as few figures as may be, ſo are Proportions to bee ſet downe in ſo ſmall numbers as may be, which is to be done by the ſelfe-ſame rule that Fractions are.

3.	4.	2.
5.	7.	1.

Againe, the order of adding, ſubtracting, multiplying, and diuiding of Proportions is much like to that of Fractions, ſauing that the adding of Proportion is to be done in ſuch manner as Fractions are to be multiplyed, and the ſubtracting of Proportions is like to the Diuiſion of Fractions, wherefore I wholly refer you to the rules of Fractions before moſt plainly taught, and ſo I end with Proportions.

Notwithſtanding I had almoſt forgotten to ſet downe one neceſſary Rule more touching Proportions, which was alſo omitted in the firſt Impreſſion, that is, how to finde out the meane Proportionall Number betwixt any two Numbers giuen, which Rule is thus, multiply the two Numbers giuen the one by the other, and the Square Root of the product ſhall bee the meane proportionall Number betwixt them. As for Example, ſuppoſe the two Numbers giuen to be 9. and 36. which being multiplyed the one into the other, the product will be 324. the ſquare Roote whereof is 18. and that is the meane proportionall number betwixt the foreſaid numbers giuen. Now how to take the Square Root of any number, is plainly taught in the 24. Chapter next following.

CHAP. XXIIII.

How to find out the Square Roote of any Number.

WHat is a Square Roote?

It is any Digit or any other Number, which being multiplyed into it ſelfe bringeth forth a ſquare Number, as 4. being multiplyed in it ſelfe, in ſaying 4. times. 4. maketh 16. which is a ſquare Number, the Roote whereof is 4. And to finde out the Square Roote of any Number be it Square or not Square, you muſt doe thus. Firſt, hauing ſet downe the number propounded which muſt conſiſt of three figures at the leaſt, ſet a pricke vnder the firſt Digit or Cypher of the ſaid Number on the right hand, that done, pricke euery other figure thereof towards the left hand, leauing alwayes one voyd ſpace betwixt euery two prickes, as you ſee here done in this number 475645 and looke how many prickes there bee, ſo many figures ſhall you haue in the quotient, and this differeth nothing in a manner from Diuiſion, the order in working is thus, firſt, ſeeke out a Digit, which being multiplyed in it ſelfe, may take away that which ſtandeth ouer the laſt pricke on the left hand, or as much thereof as may be, and ſet the Digit in the quotient, that done, double the ſaid quotient, then conſider whether the double doe conſiſt of one figure or of many, if of one only, then place that in the next voyd ſpace on the right hand, but if the double doe conſiſt of many figures, then take the firſt figure therof, that is to ſay, that figure or Cypher which ſtandeth in the firſt place of the double, and place that in the foreſaid next voyd ſpace towards the right hand, and next to that place all the reſt of the figures of the ſaid double orderly towards the left hand, that done, ſeeke another Digit, which being multiplyed in it ſelfe together with the doubled Number, may take away all that which ſtandeth right ouer it, or as much thereof as may be, which Digit you muſt not only put in the quotient to his fellow, but alſo ſet downe the ſame right vnder the next prick on the right hand, and then multiply that Digit together with the double whereto it is ioyned, by the ſayd laſt found Digit ſet downe in the quotient, the product whereof you muſt ſubtract out of the vpper Number, ſtanding right ouer the foreſaid pricke, and if there bee any remaynder, write it aboue, cancelling the other, & looke how many prickes there be, ſo many times muſt you double the quotient, obſeruing alwayes like order of working as before, which you ſhall more plainly vnderſtand by theſe examples following, and for your better vnderſtanding thereof, I will firſt giue you an Example of 3. figures only, as thus, 464: heere to finde out the ſquare Root of this Number, you muſt firſt prick the ſaid number in ſuch order as is before taught, and then ſeeke out ſome one of the 9. Digits, which being multiplyed in it ſelfe, may take away the firſt 4. on the left hand, or as much thereof as may be, which you ſhall finde to bee 2. which 2. being ſet in the

quotient, multiply the ſame in it ſelfe. in ſaying 2. times 2. maketh 4. which 4. doth cleane take away the firſt 4. ſtanding ouer the laſt pricke on the left hand, and therefore cancell the 4. that done, double the quotient which maketh 4. and ſet the ſame in the next void ſpace on the right hand vnder the figure 6. thus.

And then ſeeke out ſome Digit, which being multiplyed in it ſelfe together with the doubled, may take away the Summe of 64. that remayneth, which by asking how many times 4. is comprehended in 6. you ſhall find to bee but one, which you muſt not onely put in the quotient, but alſo ſet it downe vnder the firſt pricke on the right hand thus.

464 (2
4

So as you ſhall make the lower Summe to be 41. which is to be multiplyed by the laſt found quotient which is 1. wherefore you muſt ſay that 1. times 41. is 41. which being taken out of 64. there remayneth 23. ſo as the Roote is 21. and the remaynder 23. as the Example ſheweth.

$\cancel{4}$64(21
41

And to know whether you haue done well or not, multiply the quotient in it ſelfe, and if there bee any remainder left, adde that vnto the product of the multiplyed quotient, and if you find the ſumme thereof to bee like to the firſt, then you haue done well, if it be not like, then you haue erred, the product of this quotient being multiplyed in it ſelfe amounteth vnto 441. whereto by adding the remainder which is 23. you ſhall find the ſumme to bee like vnto the firſt number that is 464. whereof you ſought the ſquare Root. But if ſuch number doe conſiſt of many figures, then in working you muſt double the quotient once, twice or thrice, according as the number doth require, as you ſhall more plainly perceiue by this Example following: as let 50/467. by the Number whereof you would know the ſquare Root, here hauing pricked this Number in ſuch order as before, firſt ſeeke out ſome Digit, which being multiplyed in it ſelfe, may take away the Digit or Number ſtanding right ouer the laſt pricke on the left hand, which you ſhall find to be 2. and hauing ſet downe the ſaid two in the quotient, ſay 2. times 2. maketh 4. which being

23
$\cancel{4}\cancel{6}\cancel{4}$(21
$\cancel{4}\cancel{1}$

ſubtracted from 5, there remayneth 1. which you muſt ſet ouer 5. and cancell the ſaid 5. as this Example ſheweth.

That done, double the quotient which maketh 4. and ſet downe the 4. in the next ſpace towards the right hand, vnder the Cypher, as you ſee in the former Example, then ſeeke out a Digit, which being multiplyed in it ſelfe together with the double quotient, may take away all that which ſtandeth ouer the ſecond pricke towards the left hand, or as much thereof as may be; which Digit by aſking how many times 4. is comprehended in 10. you ſhall find to be 2. then ſet downe the ſaid 2. not onely in the quotient, but alſo vnder the ſecond pricke towards the right hand, which together with the former 4, maketh 42. as you ſee in this Example.

1
50467 (2
4

Then multiply that 42. in a place by it ſelfe by the figure 2. laſt ſet downe in the quotient, and it will make 84. which 84. being taken out of 104. there remayneth 20. which you muſt ſet ouer the ſecond pricke and cancell the 104. and alſo the 42. beneath, as you ſee in the former Example: that done, double the whole quotient, which maketh 44. whereof ſet the firſt 4. in the next void ſpace towards the right hand vnder the figure 6. and the other vnder the ſecond pricke, towards the left hand, then aſke how many times 4. is comprehended in 20. and you ſhall find 4. which you muſt not only ſet downe in the quotient, but alſo vnder the next and laſt pricke on the right hand, and ſo the nether ſumme ſhall be 444. which being multiplyed by the Digit 4. laſt ſet downe in the quotient will make in all 1776. which being taken out of the vpper number, which is 2067. there will remayne 291. ſo as the ſquare roote of the firſt number is 224. and the remainder 291. as you may ſee in this Example.

120
50467 (22
42
84.

The

The ſquare roote whereof being multiplied in it ſelfe amounteth vnto 50176. whereto if you adde the remainder which is 291. the ſumme thereof will be like vnto the firſt number which is 50467. Moreouer you haue to note, that if you finde any number out of the which your quotient being doubled cannot be ſubtracted, then you muſt ſet downe a Cypher in the quotient, and proceede to the next pricke on your right hand, as in this Example following.

12
12091
50467 (224
4
444
44
1776.

In which Example the firſt found Digit ſet in the quotient is 6. which being multiplyed in it ſelfe maketh 36. and cleane taketh away the firſt number, ſtanding ouer the laſt pricke on the left hand, that done, I double the quotient, which maketh 12. and I place the 2. in the next void ſpace towards the right hand, and the 1. next to that towards the left hand orderly, as in this Example.

366025 (6

Ouer which 12. there is but 6. remaining, ſo as I cannot take 12. out of 6. and therefore I cancell the 12. and ſet downe a Cypher in the quotient, thus the quotient is now 60. which being doubled maketh 120. the Cypher whereof I ſet downe in the next voyde ſpace on the right hand, and the other two Digits orderly towards the left hand, as you ſee in this Example.

366025 (60
12

Then I aſke how many times 1. is contayned in 6. & I find 5. which I ſet downe in the quotient, and alſo vnder the laſt pricke on the right hand, ſo as the nether number is 1205. which I multiply apart by it ſelfe by the 5. laſt ſet downe in the quotient, the product thereof is 6025. which being taken out of the vpper number which is alſo 6025. there remayneth nothing, as this Example ſheweth.

366025
1209 (60
12

Wherefore I finde the foreſaid number to be a iuſt ſquare number, the root whereof is 605 which being multiplyed in it ſelfe maketh 366025. a number like vnto the firſt number.

366025 (605
1205
6025

CHAP. XXV.

The vſe of the Square Roote in ſetting of Battels.

THe knowledge of finding out the Square Root of any Number, is very neceſſary for a Sergeant-Maior in the field, that he may the more readily ſet and range his Squadrones of Battell: & therefore I thinke it not amiſſe, to giue them hére certaine Examples of ſuch manner of Squares as the Italians are wont to vſe in my time, which is foure manner of wayes.

Whereof the firſt teacheth how to ſet the Battell Square of ground, the ſecond a Square Battell of men, the third a long Square Battell which we call the Hearſe Battell, and the fourth teacheth how to ſet a Battell of ſo much and a third.

Shew by what Rule the Battels are to be ſet?

Before I ſet downe any Rules, you haue to vnderſtand that all Numbers giuen or ſuppoſed, are not meet for ſuch purpoſe, but only ſuch as may be diuided into thrée equall parts, without leauing any remainder, for otherwiſe all the Rules following take no place, and therefore when any Number is giuen you, to be brought into any one of the foreſaid foure formes of Battell, you ſhall doe well firſt to diuide the Number by thrée, and if there be any remainder, to reiect it, and to take the reſt for your Number. As for Example, A Sergeant Maior is commanded by his Generall to ſet a Battell ſquare of ground, appointing him thereunto 1345. men, here the Sergeant by diuiding that Number by thrée, findeth in the remainder one man too many, which being onely reiected, all the reſt of the number which is 1344. is fit for his purpoſe.

How

How to ſet a Battell ſquare of ground, called in Italian Battaglia quadra diterreno.

NOw ſhew the order of ſetting ſuch kindes of Battell?

The order is thus: Firſt double the number giuen, then take the ſquare root thereof, and that root ſhall be the Front: that done, diuide the number giuen by the ſaid root, and the number in the quotient ſhal be the flanke: now if you multiply the front and the flanke the one into the other, you ſhall haue your whole number firſt giuen, vnleſſe there be ſome remainder left in the former Diuiſion, which remainder muſt be added to the product, to make vp the Summe. But if you would know how many men are to be put in a ranke, & alſo how many ſuch rankes you muſt haue, then diuide the front into thrée parts, and the quotient will ſhew you how many men you are to haue in a ranke, that done, multiply the flanke by 3. and the product thereof ſhall be the number of the rankes: As for example, take the number before giuen, which was 1345. which being diuided by 3. you find the remainder to be 1. which you muſt reiect, and take all the reſt, which is 1344. and that being doubled, maketh 2688. the ſquare Roote whereof is 51. by which Roote you muſt diuide the number giuen, videlicet, 1344. and the quotient will be 26. which ſhall be the flanke: now if you diuide the foreſaid front 51. by 3. the quotient will ſhew how many ſhall be in a ranke, that is 17. Finally, if you multiply the flanke, which is 26. by 3. the product thereof will be 78. which is the iuſt number of the rankes which you muſt haue.

How to ſet a Battell ſquare of men, called in Italian Battaglia quadra d'huomini.

TAke the ſquare Roote of the number giuen, and that ſhall be both the front and the flanke, which if you multiply together, the product therof wil make vp the number firſt giuen: and if you would know how many men are to be put in a rank,

and

and how many ſuch rankes you muſt haue, then doe as you did before, in diuiding the front by 3. and multiplying the flanke by 3.

How to ſet a long ſquare Battell, which we call the Hearſe Battell, and is called in Italian, Bataglia dun tanto e mezzo.

TO the number giuen, adde the iuſt halfe thereof, and the ſquare roote of that Summe ſhall be the front, by which roote or front, if you diuide the firſt number giuen, the quotient ſhall be the flanke: as for example, let the number giuen be 6144. the halfe thereof is 3072. which being added to the giuen number 6144. maketh in all 9216. the ſquare root whereof is 96. which ſhall be the front: by which root or front, if you diuide the giuen number 6144. you ſhall finde in your quotient 64. and that ſhall be the flanke: that done, diuide the foreſaid front 96. by 3. and you ſhall finde in the quotient 32. which number ſheweth how many men ſhall be in a ranke; then multiply the foreſaid flanke, 64. by 3. and the product thereof ſhall be 192. which is the number of the rankes.

How to ſet a Battell of ſo much and a third, called in Italian, Battaglia dun tanto & dun terzo.

TO the number giuen, adde the third part thereof, and the ſquare root of that Summe ſhall be the front, then diuide the firſt number giuen by the foreſaid root or front, and the number in the quotient ſhall be the flanke: as for example, let the number giuen be 1575. the third part whereof is 525. which being added to 1575. maketh in all 2100. the root whereof is 45. which muſt be the front, by which root or front, if you diuide the number giuen, which was 1575. the quotient will be 35. which ſhall be your flanke, then by diuiding 45. which is the front, by 3. the quotient will ſhew you how many men you muſt haue in a ranke, that is, 15. Againe, by multiplying the flanke, which is 35. by 3. the product thereof will be 105. which is the number of your rankes.

CHAP.

CHAP. XXVI.

How to finde out the Cubique Root of any Number.

AS the ſquare root is ſaid to be a number, which being multiplied in it ſelfe, doth make a ſquare ſuperficiall number, hauing onely length and breath, ſo the Cubique Root is a number, which being firſt multiplied in it ſelfe, and the product thereof being againe multiplyed by the firſt number, doth make a Cubique or Corporall number, hauing both length, bredth, and depth: As for example, 2. times 2. maketh 4. and 2. times 4. maketh 8. Againe, 3. times 3. maketh 9. and 3. times 9. maketh 27. and ſo you may deale with all the reſt of the 9. Digets, and make thereby a Table containing both the ſquare numbers and Cubique numbers of euery root, conſiſting of any one of the 9. Digets, like vnto this Table here following:

Roores	Squares	Cubiques
1	1	1
2	4	8
3	9	27
4	16	64
5	25	125
6	36	216
7	49	343
8	64	512
9	81	729

Then hauing to find out the Cubique roots of any number that is greater then 1000. (for leſſer it cannot be ſo worke vpon) then ſet a pricke vnder the firſt figure on your right hand, and ſo proceede towards the left hand, omitting alwayes 2. figures betwixt euerie two prickes, as in this example, 41063625, and looke how many prickes there be, ſo many figures ſhall you haue in the quotient: That done, you haue to finde out three ſeuerall numbers, firſt ſuch a Cubique number as will cleane take away the number which ſtandeth right ouer the head of the laſt pricke on the left hand, or ſo much thereof as may be, which you

you may eaſily finde in the foreſaid Table: The root of which Cubique number, you muſt ſet downe in the quotient: the ſecond number which you haue to finde, is a number called the Triple, which is eaſily had by tripling the quotient: and the third number is called the Diuiſor, which you ſhall moſt readily finde, by multiplying the quotient into the Triple, both which numbers are to be placed in ſuch order as followeth. Firſt then, hauing found the Cubique number, as is before ſaid, and taken the ſame out of the number ſtanding ouer the laſt pricke on the left hand, write the remainder (if there be any) ouer his head, cancelling that which is vnder it, and then place the Root of the ſaid Cubique number in the quotient: that done, Triple the Root ſet downe in the quotient, and that ſhall be the Triple which you muſt place in the ſecond lowe ſpace on the left ſide of the next pricke which is on your right hand, then multiply that Triple by the quotient, and the product thereof ſhall be the Diuiſor, which muſt be placed right vnder the Triple one figure ſhorter towards the left hand: that done, draw a line as you ſee in the example hereafter following, and worke thus: Firſt aſke how many times the firſt figure of the ſaid Diuiſor is contained in the number ſtanding right ouer his head: and hauing found an apt Digit for the purpoſe, put that Digit in the quotient to his fellow: that done, multiply the ſaid Digit into the Diuiſor, and ſet the product thereof right vnder the Diuiſor. Secondly, multiply the ſaid Digit in himſelfe, and againe, the product thereof into the Triple, and ſet the ſumme that comes thereof right vnder the Triple. Thirdly, multiply the ſaid Digit in it ſelfe cubically, and ſet the product thereof loweſt of all, right vnder the next pricke on the right hand: that done, draw a line, and by addition bring all the foreſaid three products into one ſumme, placing euery figure ſo, as you may eaſily take the ſaid ſumme out of the vpper number, whereof you ſeeke the Cubique root, and write the remainder (if there be any) ouer the head, and if ſuch ſumme will not be ſubtracted out of the vpper number, then you muſt ſeeke out a leſſer Digit, reſeruing ſtill the former Triple and Diuiſor, and if there be more prickes in the number

number

number then two, then you muſt for euery prick find out a new Triple and a new Diuiſor, by tripling the whole quotient, and by working continually in like order as the rule before teacheth, which rule you ſhall moſt plainely perceiue by example thus: Firſt then hauing to find out the Cubique roots of the number before mentioned, which is, 41063625, marked with prickes as before is taught, reſort to the Table wherein you ſhall find ſuch a Cubique number as will take away as much of the 41: as may be, which is 27. the root whereof is 3. for all the other Cubique numbers in the Table are either too ſmall or to too great, & therefore you muſt alwayes haue due conſideration thereof. Then take 27. which is the Cubique number out of 41. and there remaineth 14. which remainder you muſt ſet ouer the laſt pricke on your left hand, cancelling the 41. as in this example.

$$\begin{array}{ll} 14 & \\ \cancel{4}\cancel{1}063625 & (3 \end{array}$$

Then triple the quotient, which maketh 9. which you muſt ſet downe vnder the figure 6. next vnto the ſecond prick which is on your right hand: Then to find out the Diuiſor, multiply the Triple 9. by 3. which is the quotient, and the product thereof ſhall be the Diuiſor: which Diuiſor you muſt place right vnder the Triple one figure ſhorter towards the left hand: that done, draw a line as you ſee in this example.

$$\begin{array}{lll} & 14 & \\ & \cancel{4}\cancel{1}063625 & (3 \\ \text{Triple} & \vert 9 & \\ \text{Diuiſor} & 27 & \\ \hline \end{array}$$

Now hauing orderly ſet downe the Triple and the Diuiſor, aſke how many times 2. which is the firſt figure of the Diuiſor, is contained in 14. ſtanding right ouer his head, and remember to make choiſe of ſuch a Digit, as may not cleane take away the whole number at the firſt, but rather leaue ſo much as the ſaid quotient, hauing afterward to be multiplyed diuers wayes, as ſhall be ſaid hereafter, may take away the reſt, or as much thereof as may be, as in this example following, you ſhall find the apteſt Digit for this purpoſe to be 4. which you muſt put in the quotient, whereby the quotient ſhall be now 34. that done, you muſt firſt multiply this laſt quotient,

which

which is 4. into the Diuiſor 27. the product whereof is 108. which you muſt ſet downe right vnder the Diuiſor, beneath the line already drawne, as you ſee in this example.

```
        14
        41063625   (34

Triple--| |
Diuiſor--27
------------------
        108
```

Secondly, you muſt multiply the ſaid 4. in it ſelfe quadrantly, which maketh 16. then multiply that 16. by the triple 9. the product whereof is 144. which is to be ſet right vnder the Triple, as in this example.

Thirdly, you muſt multiply the ſaid 4. in it ſelfe cubically, which maketh 64. which is to be ſet right vnder the next pricke on the right hand, beneath the former ſummes, as you ſee in this other example.

```
        14
        41063626   (34
Triple--| |
Diuiſor---27|
------------------
        108|
         144
```

So as euery one of the foreſaid three products doe extend one further then another by one figure towards the right hand, as you ſee in the former example: Now theſe products being thus placed, draw another line, & bring all the three ſeuerall products contained betwixt the two lines into one ſumme, by Addition, and you ſhall find the totall ſumme to be 12304. which being ſubtracted out of the number ſtanding right ouer it, which is 14063. there will remaine 1759. which you muſt ſet downe aboue, as you ſee in this example.

```
        14
        41063625
Triple      91
Diuiſor     27||
------------------
        108||
         144|
           64
```

```
          1
        14759
        41063625   (34
Triple      9
Diuiſor     27 ||
------------------
        108 ||
         144 |
           64
------------------
        12304
```

Now to proceed with the next, you muſt find out a new Triple and a new Diuiſor.

How is that done?

Thus multiply the whole quotient, which is 34. by 3. the product whereof is 102. and that is the Triple, which is to be placed

placed in the next void ſpace, hard by the next pricke that is on your right hand. Then multiply the whole quotient into the laſt found Triple 102. and the product thereof, which is 3468. ſhall be your Diuiſor, which is to be placed vnder the Triple one figure ſhorter towards the left hand, as you ſee in the example following: which two numbers being thus found, & rightly placed, draw a line, then aſke how many times the firſt figure of your Diuiſor, which is 3. is contained in the number right ouer his head, which is 17. and you ſhal find it to be 5. times contained therein, wherefore ſet downe 5. in the quotient: that done, multiply 5. in the Diuiſor, and place the product thereof which is 17|340. right vnder the Diuiſor, beneath the line, as you ſee in this example.

```
          1
         14759
        41063625   (345
Triple      102
Diuiſor    3468
------------------
          17340
```

Secondly, ſquare the ſame 5. that is to ſay, multiply it in it ſelfe, and that maketh 25. which 25. you muſt multiply againe into the Triple 102. the product whereof is 2550. which number you muſt ſet right vnder the ſaid Triple, beneath the line. Thirdly, multiply the ſaid 5. in it ſelfe Cubically, which maketh 125. and place that right vnder the firſt pricke on the right hand, and draw a line: that done, adde all the foreſaid three products together, and you ſhall find the totall ſumme thereof to be 1759625. which being ſubtracted out of the vpper number, there remaineth nothing, as this example plainely ſheweth.

```
        1
       14759
      41063625   (345
      Triple     102
      Diuiſor 3468
------------------
        17340
          2550
            125
------------------
        1759/625
```

Whereby you may conclude, that the foreſaid number whereof you ſought the root, is a perfect Cubique number: for if you multiply the whole quotient in it ſelfe Cubically, it will produce the ſelfe ſame number whereof you ſought the root. But note, that if in making the firſt Subtraction, the firſt Diuiſor is not to be found in the vpper number, then

you

you muſt ſet a Cypher in the quotient, that done, triple the whole quotient, & place the ſaid Triple vnder the figure which is next to the next pricke on the right hand, working in ſuch order as before: and to auoide confuſion, hauing to deale with a multitude of numbers, it ſhall not be amiſſe at the finding out of euery new Triple and Diuiſor, to ſet the remainders in ſeuerall places by themſelues, and to worke then in the ſelfe ſame order that is before taught: alſo note, that if you haue to deale with a few numbers, and that the Diuiſor cannot be ſubſtracted out of the number ſtanding right ouer his head, then you muſt ſet a Cypher in the quotient, and ſo you haue done. As for example, hauing to take the Cubicall Root of 8597, here I find 2. to be the quotient, which being cubically multiplyed, doth cleane take away the 8. and now according to my former rule 12. muſt be my Diuiſor, which becauſe I cannot take it out of 5. I ſet downe therefore a Cypher in the quotient, ſo as the quotient is now 20. which is the Cubicall Root of the foreſaid number: for if you multiply 20. cubically, and adde thereunto 567. which is the remainder, the ſumme thereof will be like vnto the firſt number, as you may ſee in this example.

```
                              20
8 567.                        20
 . .                    ----------
   6   Triple (20            400
  12   Diuiſor                20
                        ----------
                            8000
                             567
                        ----------
                            8567
```

CHAP. XXVII.

Of Aſtronomicall Fractions.

Becauſe the Vſe of theſe Fractions is verie neceſſarie, for thoſe that haue to calculate the Motions of the Starres and the difference of Time, I thought good to ſhew here how the ſame are to bee added, ſubtracted, multiplyed, and diuided, for the meaſure of Time falleth not out alwayes to be a whole yeere, moneth, day, or houre, nor the mouing of the Celeſtiall bodies are to bee meaſured alwayes by whole Circles, Signes, or whole Degrees, and therefore to haue an exact meaſure of ſuch things it was thought beſt by the ancient Writers to diuide all whole things called Integra into the leaſt parts that might bee, for which purpoſe no Number was thought ſo meete as 60. for there is no number vnder 100. that receiueth ſo many Diuiſions as 60. which may bee diuided many ſundry wayes, that is, by 2. 3. 4. 5. 6. 10. 12. 15. 20. and by 30. and therefore they diuide euery whole thing that had no vſuall parts into 60. minutes, and euery minute into 60. ſeconds, and euery ſecond, into 60. thirds, and ſo forth into 60. fourths, fifts, ſixts, ſeuenths, eights, ninthes, and tenthes, and further if need were, but that ſeldome chanceth. And you haue to note that minutes are marked with one ſtreeke ouer the head, ſeconds with two ſtreekes, thirds with three ſtreekes, and ſo forth thus, $23'.\ 6''.7'''.8''''.$ &c. which doe ſignifie 23. minutes 6. ſeconds, 7. thirds, and 8. fourths.

Of Addition.

WHat is to be obſerued in adding of theſe kinds of Fractions?

Firſt, that you bring Integrums to Integrums, and Fractions to Fractions, that bee of like denomination, beginning alwayes with the leaſt on the right hand, and if the ſumme of ſuch Addition doe amount any where to the number of 60. or aboue 60. then you muſt looke how many 60. are comprehended therein, & for euery 60. adde one to the next greater Fraction that is on the left hand, obſeruing ſtill that order vntill you come to the Integrums, of which Integrums it is alſo neceſſary to know their value, that is to ſay, what parts they contayne and what denomination thoſe parts haue. As for Example, if you adde common Signes ſuch as the 12. Signes of the Zodiake be, then euery ſigne cōtayneth 30. degrees ſo as euery ſumme exceeding 30. is to bee diuided by 30. but if they bee

Phyſicall ſignes, whereof 6. do make a whole circle, ſuch as bée ſet downe in the Table of Alponſus, then the ſumme of thoſe degrées is to be diuided by 6. Moreouer, ſo often as the ſumme of the common ſignes doe excéed 12. or the ſumme of the Phyſicall ſignes doe excéed 6. the ouerplus is alwayes to bée reiected, and the remainder to be ſet in the place of the ſignes, as you may ſée in this Example following, wherein Seconds are reduced to Minutes, minutes to degrées, & finally degrées to ſignes.

An Example of Addition conſiſting of Signes, Degrees, Minutes and Seconds.

	Signes	Degrees	Minutes	Seconds
	9	19	1	19
	0	0	35	16
	11	29	33	5
	9	29	38	11
	0	11	49	40
			4	56
Summa totalis	8	0	42	27

In which Example beginning firſt with the ſeconds, becauſe they are here ẏ leaſt Fractions, you ſhall find by addition that the ſumme of them amounteth to 147. which being diuided by 60. you ſhall find in the quotient 2. & the remaynder to be 2″7. which remaynder you muſt ſet downe vnder the Collum of Seconds, keeping the quotient which is 2. in minde to be added to the Collum of Minutes, the Summe whereof is 162. which being diuided by 60. you ſhall finde in the quotient 2. degrées, and the remaynder to be 4′2. which is to be ſet downe vnder the collum of minutes, and the quotient 2. kept in minde to bee added to the Collum of degrées, the Summe whereof is 90. degrées, which being diuided by 30. (becauſe that 30. degrées doe make one common whole ſigne) you ſhall finde in the quotient 3. ſignes and no remaynder: wherefore you muſt ſet downe a Cypher vnder the Collum of degrées, and adde 3. ſignes to the Collum of ſignes, the ſumme whereof is 32. which if you diuide by twiſe 12. which maketh 24. you ſhall find the remaynder to be 8. ſignes, which

is to be ſet downe vnder the collum of ſignes for the quotient, hére is to bée reiected, according to the Rule before giuen, ſo as the totall Summe of this Addition is 8. ſignes, 0. degrées 4′2. 2″7.

Another Example of Dayes, Houres, Minutes, and Seconds to be added together.

	Dayes	Houres.	Minutes	Seconds
	21	14	32	11
	16	16	19	41
	8	16	30	30
Summa totalis	46	23	22	22

In this Example one ſelfe order as in the other before is to bee obſerued as touching the Seconds and Minutes, for the excéeding number in both, are diuided by 60. but when you come to the houres, you muſt diuide that Number by 24. becauſe that ſo many houres doe make a whole day, and hauing ſet downe the remaynder vnder the Collum of houres, adde that one day which was in the quotient, vnto the Collum of dayes, and ſo you ſhal find the totall Summe to be as the Example aboue ſheweth.

Of Subtraction.

WHat order is to be obſerued in Subtraction,

The ſelfe-ſame that was before obſerued in Addition, ſo as you alwayes remember, that when you haue to take a greater number of Fractions, as of Minutes, Seconds, Thirds, and ſuch like, out of the leſſer Number of Fractions, to borrow 60. and hauing ſet downe the remaynder, to adde the one borrowed, vnto the next Collum on the left hand, for there the 60. borrowed, is but one, but if you haue to deale with degrées, which are counted Integrums, then you muſt borrow but 30. for ſo many degrées doe make one ſigne, and if you haue to ſubtract houres, then you muſt borrow 24. for ſo many houres doe make one day, as by the Example hére following, you ſhall more plainly perceiue.

Signes	Degrees	Minutes	Seconds
8	0	42	27
0	1	9	53
7	29	22	34

In this Example becauſe you cannot take 5″3 out of 2″7 you muſt borrow one minute from the next Collum on the left hand, which one minute is 6″0. which being added to 27. doe make in all 8″7, out of which if you take 5″3. there will remayne 3″4. that done, you muſt pay home the minute which you borrowed by adding the ſame unto the next 9. on the left hand, which maketh 10. then ſay, take 1′0. out of 4′2. and there remayneth 3′2. which being ſet downe, proceed to the next. But heere to take one out of none that cannot bee, and therefore borrow one whole ſigne from the Collume of ſignes, which is 30. degrees, from whence take one and there remayneth 29. which being ſet downe, take the one which you borrowed out of 8. and there remayneth 7. ſo as the whole remaynder of this Subtraction is 7/ ſignes, 29/degrees, 3′2 / and 3″4. as the former Example ſheweth.

Multiplication.

Though there be more difficulty in multiplying and diuiding Aſtronomicall Fractions, then in adding or ſubtracting them, yet the greateſt difficulty thereof, chiefly conſiſteth in the finding out of the true denomination of the products, for firſt as touching Multiplication, you muſt multiply euery number of the multiplyer into all the particular Numbers of the ſumme that is to be multiplyed, and then ſeuerally to adde together the products that bee of one ſelfe denomination, and whatſoeuer in that Addition ariſeth to the number of 60. or exceedeth 60. it is to be reduced by the Sexaginary Diuiſion into the greater ſumme, ſo ſhall you collect the whole ſumme of the Multiplication. But you haue to note by the way, that if there bee any Integrums of diuers denomination, in your Multiplyer: That then ſuch Integrums muſt bee reduced to one ſelfe kinde of Integrums: As for Example, ſuppoſe that you would multiply the daily motion of the Moone, which according to Alphonſus Tables is 13. degrees, 1′0. 3″5. and 1‴. by 29. dayes 12. houres, 4′4. and 3″. here becauſe there bee in this multiplyer Integrums of diuers denominations, that is to ſay, dayes and houres, you muſt therefore reduce the ſame into one ſelfe denomination, before that you can make your Multiplycation.

How is that to be done?

By multiplying euery Number of the ſayd Multiplyer by 5 and then by halfing the product thereof, by which halfing you ſhall reduce Minutes to ſeconds, and Seconds to Thirds, & ſo forth, to the ſmalleſt Fractions of all, and if any product doe amount to 60. or exceed 60. then you muſt diuide the product by 60. the remaynder whereof is to bee ſet under his proper Denomination, & you muſt keepe the quotient in mind to adde the ſame to the next greater Number, as this Example or Table ſheweth: in the Front whereof I haue ſet downe in ſeuerall ſpaces, not onely the Denominations of the two Integrums, as dayes and houres, but alſo the Denominations of ſo many Fractions as I thinke meete to ſerue my turne, under which front I place the foreſayd Multiplyer, and then draw a Line as you ſee in this Example following.

Denomination.	Dayes	Houres	′	″	‴	⁗
The Multiplyer to bee reduced into one ſelfe Denomination.	29	12	44	3		
The products of the reduction.		29	21	50	7	30

Now beginning firſt on the right hand with the leaſt Fraction of the ſaid Multiplyer, which is 3″. I multiply 3. by 5. which maketh 15. the one halfe whereof is 7‴. and halfe a third which is 3⁗0. wherefore I ſet downe the ſayd 7‴. and 3⁗0. under their proper denominations as you ſee in the Example aboue, then I multiply 4′4. by 5. the product whereof is 220. and the halfe thereof is 110. which being diuided by 60. the quotient is 1′. and the remaynder 5″0. which remaynder I ſet under his proper denomination, keeping the quotient ſtill in minde, that done, I multiply 12. houres by 5. the product whereof is 60. and the halfe of that is 3′0. whereunto by adding the one which I had in minde, I make it 3′1. and ſo I ſet it downe vnder his proper denomination, & becauſe there be no more Fractions to be multiplyed, I ſet downe on the left hand the Integrum 29. and by this meanes I haue brought the foreſaid Multiplyer to one ſelfe denomination and to one kind of Integrum, that is to ſay, to 29. dayes, 3′1. $\overset{''}{50}$. $\overset{'''}{7}$. $\overset{''''}{30}$. which now being the greater number is to be ſet aboue, and to be multiplyed by the foreſayd daily motion of the Moone that is, 13. degrées, 1′0. $\overset{''}{35}$. and $\overset{'''}{1}$: but to the intent that in multiplying theſe Numbers together, you may ſet euery product in his true place, that is to ſay, vnder his proper denomination, it ſhall not be amiſſe in the front of your worke to ſet downe two rowes of Numbers, whereof the firſt muſt contayne ſo many denominations or Fractions as you thinke good, as Minutes, Seconds, Thirds, Fourths, and ſo forth, marked with ſtrékes and vulgar Numbers, and the ſecond row ſhall be the naturall order of Numbers, written in Arithmeticall figures as this Table ſheweth.

Integra.	′	″	‴	⁗	v	vi	vii	viii	The Denominations.
0	1.	2.	3.	4.	5.	6.	7.	8.	The naturall Numbers.

Vnder which Table you muſt firſt ſet the Number that is to be multiplyed, and right vnder that the Multiplyer in ſuch ſort as euery particular Product may bee placed vnder his proper Denomination, and then draw a Line as you ſée in this Example following, and when you haue multiplyed two numbers the one into the other, and know not where to place the Product, then marke vnder which of the naturall Numbers in the Front, the ſaid two Numbers, that is to ſay, the Multiplyer and the Multiplicand doe ſtand: That done, adde thoſe two naturall Numbers of the front together, and the Summe thereof will ſhew you vnder what denomination the Product is to be placed, as in this Example.

Integ.	′	″	‴	⁗	v	vi	vii	Denominations.
0	1	2	3	4	5	6	7	Naturall numbers.
29	31	50	7	30				The Multiplicand
13	10	35	1					The Multiplyer.
			29	31	50	7	30	The ſeuerall Products.
		1015	1085	1750	245	1050		
	290	310	500	70	300			
377	403	650	9	390				The generall Product or totall Summe.
389	6	24	2	31	12	37	30	

In which Example I firſt multiply $\overset{'''}{1}$. into $\overset{''''}{30}$. the product whereof is $\overset{vii}{30}$. which muſt be ſet vnder the Denomination vii. becauſe the two naturall Numbers that is, 3. ſtanding ouer 1. the Multiplyer, & 4. ſtanding ouer 30. the Multiplicand, being added together doe make 7. appointing to the product his proper denomination, then multiply againe the ſame $\overset{'''}{1}$. into $\overset{'''}{7}$. the product whereof is $\overset{vi}{7}$. which muſt be ſet vnder the denomination vi. becauſe 3. ſtandeth ouer both their heads, and therefore muſt be taken 2. that is to ſay, for each Number 3. which being added together doe make 6. appointing thereby to the product his proper place of denomination, that done, multiply the ſaid $\overset{'''}{1}$. into $\overset{''}{50}$. the product whereof is $\overset{''}{50}$. which muſt bée ſet vnder the denomination v. for the 3. which ſtandeth ouer 1. and 2. ouer $\overset{''}{50}$. being added together maketh 5. appointing to the product his proper place of denomination, then multiply the ſayd $\overset{'''}{1}$. into 3′1. the product whereof is $\overset{''''}{31}$. here the two naturall Numbers, that is to ſay, 3. ſtanding ouer $\overset{'''}{1}$. and 1. ouer 3′1. being added together, do make 4. appointing to the product his proper place of denomination, then multiply the foreſaid $\overset{'''}{1}$. into 29. Integrums, the product whereof is $\overset{'''}{29}$. & muſt be ſet vnder the denomination, ‴ becauſe 3. ſtandeth ouer $\overset{'''}{1}$. but 29. being & Integrum, hath no naturall Number ſtanding ouer him but a Cypher, thus hauing gone throughout all yͤ numbers of the Multiplicand, with the firſt Number of the Multiplyer, procéed in like order with the ſecond number of the Multiplyer, which is, $\overset{''}{35}$. which being multiplyed into $\overset{''''}{30}$. maketh $\overset{vi}{1050}$.

to be ſet vnder the denomination vi. becauſe 2. ſtandeth ouer $\overset{''}{35}$. the Multiplyer, and 4. ouer $\overset{''''}{5}$. the Multiplicand, which 4. and 2. being added together maketh 6. then multiply $\overset{''}{35}$. by $\overset{'''}{7}$. which maketh $\overset{v}{245}$. which you muſt ſet downe vnder the denomination v. becauſe 2. and 3. maketh 5. that done, multiply $\overset{''}{35}$. by $\overset{''}{50}$. which maketh $\overset{''''}{1750}$. which you muſt ſet downe vnder the denomination '''' becauſe the Multiplicand and the Multiplyer are both vnder the denomination '' which being twice repeated maketh 4. then multiply $\overset{''}{35}$. by 31'. and that maketh $\overset{'''}{1085}$. which you muſt ſet downe vnder the denomination ''' becauſe 1. and 2. maketh 3. finally multiply 29. Integrums, by $\overset{''}{35}$. and that maketh $\overset{''}{1015}$. thus as you haue gone through with two Numbers of your Multiplyer, ſo procéed in like Order with the other two Numbers of the Multiplyer, which is 10. and 13. and when you haue ended your Multiplication, and ſet euery product in his proper place, and ſo as euery figure may ſtand one right vnder another, to auoyde confuſion when you come to Addition, (to which end the ſpaces of Collums had néed to be the larger) then draw a Line vnder all the products, and beginning on the right hand, adde all the products contayned in euery ſeuerall Collum together, and if the Summe of any ſuch particular Addition doe ariſe to the Summe of 60. or excéed the Number of 60. then diuide that Summe by 60. and ſet downe the remaynder, kéeping the quotient in minde, to bee added to the product of the next Collum on the left hand, ſo ſhall you find the total Summe of your multiplication to be 389. degrées, 6'. $\overset{''}{24}$. $\overset{'''}{2}$. $\overset{''''}{31}$. $\overset{v}{12}$. $\overset{vi}{37}$. and $\overset{vij}{30}$. as the former Example plainly ſheweth. Now if you diuide 389. degrées by 30. becauſe euery common ſigne contayneth 30. deg. you ſhal find your totall Sum to be 12. ſignes 29. degrées, 6' $\overset{''}{24}$. $\overset{'''}{2}$. $\overset{''''}{31}$. $\overset{v}{12}$. $\overset{vi}{37}$. and $\overset{vij}{30}$. and ſo much the Moone runneth in the ſpace of 29. dayes 12. houres 4'4. and $\overset{''}{3}$. of an houre, which is her full reſolution betwixt euery two changes, but for as much as it chanceth as well in this Example as in many others like, that Integrums of two ſundry denominations are propounded in the queſtion, it may very well be doubted with what denomination the product of ſuch Multiplication is to be named, as in this Example hauing multiplyed time by motion, a man may aſke whether the product ſhall bee named dayes, or degrées, the reſoluing of which doubt dependeth vpon the nature of the queſtion propounded, for in the foreſaid Example, becauſe time of dayes doe comprehend any certaine appointed motion, therefore the product of the Multiplication is to bee referred to the degrées of motion which are comprehended vnder time, & not to time, which comprehendeth motion, wherefore this product of Integrums viz. 389. ſignifieth here degrées and not dayes, ſo likewiſe when degrées & minutes are multiplyed by myles and minutes, the product of ſuch Multiplication taketh his name from miles and not from degrées, becauſe degrées doe comprehend myles, for we ſay in matters of Geography, that euery degrée of the great Circle comprehendeth 60. myles, thus hauing ſpoken ſufficiently of the Multiplication of Aſtronomicall Fractions, wee will now procéed to the Diuiſion of ſuch Fractions.

Of the Diuiſion of Fractions Aſtronomicall.

WHat is to be obſerued therein?

Firſt, you muſt conſider whether your Diuiſor bee compound, or ſimple, I call that compound which contayneth Fractions of diuers denominations, and that ſimple which conſiſteth of Integrums, or is one whole Number of one ſelfe Denomination, wherein there is no difficulty, for then you haue no more to doe but to diuide euery particular Number contayned in the diuidend by that ſame Diuiſor, and to place the product of euery one vnder ſuch denomination, as the little Table of denomiations ſheweth, and therefore it ſhall not be amiſſe to ſet the foreſayd little Table ouer your diuidend euen as you did in Multiplication: Alſo the Sexagenary progreſſion is alwayes to be vſed;, aſwell in Diuiſion as in Multiplication. Moreouer if your Diuiſor be not exactly contayned in the diuidend, then hauing multiplyed the diuidend by 60. you muſt adde to the product thereof the next Fraction following: As for Example, knowing by Alphonſus Tables, that the daily Motion of the Moone is 13. Degrées 1'0. $\overset{''}{35}$. $\overset{'''}{1}$. $\overset{''''}{15}$. you would

would know how much ſhe goeth in the ſpace of an houre, here becauſe that one day containeth 24. houres, the number muſt be 24. your Diuiſor, which is ſimple & not compound: firſt then ſet downe in the front of your worke the row of denominations only, and not the natural numbers, becauſe they are not to be vſed in this way of Diuiſion, that done, right vnder the row of denominations, place your Diuidend, and right vnder that your Diuiſor, as you ſée in this example.

Degrees	′	″	‴	⁗	v	
						The Denominat.
13	10	35	1	15		The Diuidend.
24						The Diuiſor.
	32	56	27	33	7	The ſeuerall ſumme of euery quotient.

In which example, becauſe the Diuiſor 24. is not contained in 13. therefore I multiply 13. by 60. which maketh 780. wherunto by adding the next Fraction on the right hand, which is 1′0. the whole ſumme is 79′0. which being diuided by 24. the quotient is 3′2. which becauſe they are minutes, I place them vnder the denomination of minutes, and the remainder is 2′2. which being multiplyed by 60. maketh $\overset{\prime\prime}{1320}$. whereunto I adde the next figure, which is 35. and ſo the whole ſumme is $\overset{\prime\prime}{1355}$. which being diuided by 24. the quotient is $\overset{\prime\prime}{56}$. which I place vnder the denomination of ſeconds, and the remainder of this Diuiſion is $\overset{\prime\prime}{11}$. which being multiplyed by 60. maketh $\overset{\prime\prime\prime}{660}$. whereto I adde the next Fraction, which is $\overset{\prime\prime\prime}{1}$. ſo that now the whole ſumme is $\overset{\prime\prime\prime}{661}$. which being diuided by 24. the quotient is $\overset{\prime\prime\prime}{27}$. which I ſet downe vnder the denomination of thirds, and the remainder is $\overset{\prime\prime\prime}{13}$. which being multiplyed by 60. maketh $\overset{\prime\prime\prime\prime}{780}$. whereunto I adde the next Fraction, which is $\overset{\prime\prime\prime\prime}{15}$. which maketh in all $\overset{\prime\prime\prime\prime}{795}$. which being diuided by 24. the quotient is $\overset{\prime\prime\prime\prime}{33}$. which I place vnder the denomination of fourths, and the remainder is $\overset{\prime\prime\prime\prime}{3}$. which being multiplied by 60. maketh $\overset{v}{180}$. whereunto hauing no Fraction to adde, I diuide the ſame by 24. and ſo I find in the quotient $\overset{v}{7}$. which I ſet vnder the denomination of fifths, ſo as I find the hourely motion of the Moone to be 3′2. $\overset{\prime\prime}{56}$. $\overset{\prime\prime\prime}{27}$. $\overset{\prime\prime\prime\prime}{33}$. $\overset{v}{7}$. and ſomewhat more, for I leaue to deale any further with the ſmaller Fractions, that would ſtill grow by multiplying the remainders by 60.

thinking this ſufficient to ſhew you in what order you haue to worke, to diuide your Diuidend by a ſimple Diuiſor, into as many ſmall parts as you will: but if your Diuiſor be compound, then the diuiſion is to be done eyther by reduction into the ſmalleſt Fractions, or without reduction: which laſt way is very hard and tedious, and therefore I will onely ſhew you how to make your diuiſion, whereof the Diuiſor is compound by reduction, and that by this one Example here following. Suppoſe then, that the Moone according to her owne courſe, which is from Weſt to Eaſt, is diſtant from ſome fixed Starre 36. degrées, 3′0. $\overset{\prime\prime}{24}$. $\overset{\prime\prime\prime}{10}$. and $\overset{\prime\prime\prime\prime}{15}$. and that you would know in what time ſhe will run that diſtance, according to her daily mouing, which as hath bin ſaid before, is 13. degrées, 1′0. $\overset{\prime\prime}{35}$. $\overset{\prime\prime\prime}{1}$. and $\overset{\prime\prime\prime\prime}{15}$. here to make this diuiſion by reduction, you muſt doe thus. Firſt, reduce all the numbers of your Diuidend into the ſmalleſt Fractions thereof, by the Sexagenarie Multiplication, and Addition of the next Fraction vnto the product of that Multiplication, that done, reduce all the numbers of your Diuiſor by like Multiplication and Addition into the ſmalleſt Fractions, ſo as the Diuidend and the Diuiſor may be both of one ſelfe denomination, and diuide the one by the other, euen as they were Integrums, as in this example you muſt firſt multiply 36. degrées by 60. and it will make 216′0. whereto by adding 3′0. you make the whole ſumme of minutes to be 219′0. which being multiplyed againe by 60. doe make $\overset{\prime\prime}{131433}$. whereto if you adde the $\overset{\prime\prime}{24}$. the ſumme of ſeconds will be $\overset{\prime\prime}{131424}$. and ſo procéeding ſtill with the Sexagenarie Multiplication and Addition of the next Fraction, as you did before, you ſhall find the Diuidend to be $\overset{\prime\prime\prime\prime}{473129451}$. Then in like order reduce your Diuiſor into the ſmalleſt Fraction, and you ſhall find the totall ſumme thereof to be $\overset{\prime\prime\prime\prime}{173766075}$. This reduction being made, diuide the Diuidend by the Diuiſor, ſo ſhall you find in the quotient two Integrums that is to ſay, two dayes, and the remainder to be $\overset{\prime\prime\prime\prime}{132597365}$. which remainder if you multiply by 60. and diuide the product by the ſelfe-ſame Diuiſor, & you ſhall haue in the quotient minutes, then multiply againe that remainder by 60. and diuide the product thereof by the ſame

Diuiſor, and you ſhall haue in the quotient ſeconds, and ſo by obſeruing ſtill that order, you ſhall bring it into as ſmall Fractions as you will: thus ſhall you find, that the Moone, according to her dayly motion, will run the foreſaid ſpace of diſtance that was betwixt her and the fixed Starre, in two dayes, 4′6, and 1″4.

Chap. XXVIII.

How to diuide Aſtronomicall Fractions, when the Diuiſor is greater then the Diuidend.

Though by the laſt Chapter you may learne how to diuide any number in Aſtronomicall Fractions, whereof the Diuiſor is greater then the Diuidend; yet I mind once againe to ſet downe a generall Rule, to ſerue for ſuch purpoſe, becauſe it commeth often in vſe, in hauing to deale with Aſtronomicall Tables, and to giue you example thereof: Firſt then hauing to diuide any number, whoſe Diuiſor is greater then the Diuidend, do thus: multiply the greateſt denomination of the Diuidend by 60. and if there be any Fractions annexed thereunto, which are of the next inferior kind, as minutes are to degrées, or to houres, and ſeconds to minutes, and thirds to ſeconds, &c. then adde them to the former product: but if ſuch Fractions be not of the next inferior kind, then let them ſtand as they are, vntill you come to deale with them, and hauing diuided according to the common Rule of Diuiſion, the firſt ſumme of the diuidend by the Diuiſor, multiply the quotient into the whole Diuiſor, and ſubtract that product, but of the vpper number if it may be, if not, then take the quotient leſſer and leſſer, vntill you can find ſuch a number as will be ſubtracted out of the ſaid vpper number: and if there be any remainder left, then multiply that remainder by 60. not leauing to follow the former order of working, vntill you haue found the néreſt exact quotient that may be. And you haue to note, that the denomination of the firſt quotient muſt be of the next inferiour kind, to that denomination which the Diuiſor hath: and to make this rule the plainer, I will ſet downe an example vſed by Stadius in the 115. Page of his Ephemerides, who to know the very inſtant of the full Moone the ſecond of March, 1569. biddeth to diuide the diſtance of the oppoſition, which was 8. degrées 4′6. by the diurnall exceſſe of the Moones motion from the Sun, which was then 13. degrées, 4′8. which Diuiſor, becauſe it is greater then the Diuidend, you muſt according to the rule before giuen, worke thus: Firſt, multiply the greateſt denomination of the Diuidend, which is 8. degrées by 6′0. the product whereof will be 4′80. whereunto by adding the Fraction annexed, videlicet, 4′6. it maketh in all 52′6. which is to be diuided by 13. degrées 4′8. here in diuiding the laſt product firſt by 13. degrées, I find in the quotient 39. which is one tœ many, conſidering that I muſt take out of the foreſaid Diuidend 4′8 as often as I did take out thereof 13. degrées, wherefore I ſet downe but 38. in the quotient, and then the remainder will be 96. which becauſe I may eaſily diuide by the common Diuiſor 13. degrées, and 4′8. I diuide therefore that 96. firſt, 13. whereof the quotient is 7. and the remainder is 5. which I reduce into ſeconds, by multiplying that 5. by 6. the product whereof is ,″.. that done, I multiply 4′8. by 7. the product whereof is 336. which though it be ſomewhat tœ great a number to be taken out of 300. yet I let it ſtand, becauſe it approcheth to a very nigh exactneſſe, and by this meanes I find the whole quotient to be 3′8. and ″;. and you haue to note, that if after the firſt quotient be ſet downe, there happen any remainder which is leſſer then the Diuiſor, then you muſt ſet downe a Cypher in the quotient, and remoue your Diuiſor one place farther, euen as you doe in common Diuiſion, and then to worke as before.

CHAP. XXIX.

How to take the ſquare Roote of Aſtronomicall Fractions.

THe greateſt difficulty hereof conſiſteth in finding out the true denomination of the root, for if the Fraction be ſeconds, then the root thereof are minutes, and if the Fraction be fourths, then the root are ſeconds, for the Fraction muſt alwayes haue ſuch denomination as may be halfed, ſeconds, fourths, and ſuch like, the one halfe whereof giueth alwayes name to the root, for if the queſtion be of thirds, you muſt firſt reduce them to fourths, before you can take the root, and you muſt do the like with any other Fraction, whoſe denomination is odde and not euen. As for example, if you would take the root of 43'''. heere by multiplying theſe 43'''. by 60. you ſhall reduce them into 2580''''. the root whereof is 50''. Moreouer, the Fractions wherewith you haue to deale, are eyther ſimple or compound: if they be ſimple, and leſſe then minutes, and therewith haue euen denomination, and not odde, then you néed to make no further reduction, but to worke as if you had to deale with whole numbers. As in ſeeking the ſquare root of 1600''''. you find it to be iuſt 4'0. but if the number be compounded, that is to ſay, conſiſting of Integrums and Fractions, or of many Fractions hauing diuers denominations, then you muſt firſt reduce them all to the ſmalleſt Fraction that hath an euen denomination, before that you can take the root. As for example, you would know the root of 4. degrées 2'5. here you muſt by the Sexagenary, Multiplication, and Addition of the next Fraction reduce the degrées to minutes, & the minutes to ſeconds, as you were taught before in diuiſion, and then to worke as you were wont to doe in taking the ſquare root of whole numbers, and in ſo doing, you ſhall find the ſumme of ſeconds to be 15876''. the ſquare root whereof is 12'6: which if you diuide by 60. it will make 2. degrées, 6'. Another example, as to take the root of 13. degrées 4'2. and 4"5. here by reduction as before, you ſhal bring the degrées and minutes to 4936"5. the ſquare root whereof is 222'. which being diuided by 60. maketh 2. degrées, 4'2. And thus I end with the Aſtronomicall Fractions: which kind of Fractions though they be very learnedly and orderly taught by Reinoldus in the beginning of his Prutenicall Tables, yet in mine opinion, not in ſo plaine order, and ſo fit for euery mans vnderſtanding, as I haue here ſet them downe, according to the doctrine of Gemma Friſius, which being once learned, you ſhall the ſooner attaine to the other. And without the knowledge of theſe Fractions, you can neuer truly calculate any thing out of the Aſtronomicall Tables, and therefore ſuch Fractions are moſt neceſſary to be learned.

Notwithſtanding, the better to calculate by the ſaid Prutenicall Tables, or by any other Aſtronomicall Tables, I muſt ſet downe here one thing more, which I had cleane forgotten in my firſt Edition, that is, to declare vnto you, that in thoſe Tables are often vſed two kindes of denominations, whereof the one is called Sexagenæ, and the other Sexageſimæ, and that the denomination Sexagenæ being ſet ouer any number, doth ſignifie, that the vnite of the Integrum is multiplied by 60. But the denomination Sexageſimæ doth ſignifie, that the vnite of the Integrum is diuided by 60. and you haue to note, that Sexagenæ haue the like parts or denominations that Sexageſimæ haue, as Primes, '. ''. '''. and ſo forth, differing only in placing the ſaid denominations, for the denominations of the Sexagenæ are alwayes ſet on the left hand of their Integrums, but the denominations of the Sexageſimæ are ſet on the right hand of their Integrums. And to eaſe you of your paine as well in multiplying and in diuiding, as alſo in taking the ſquare Root of Aſtronomicall Fractions, I haue thought good to ſet downe this Table here following, called the Sexagenarie Table, together with the deſcription and vſe thereof, which Table is alſo ſet downe in my firſt Edition.

The

The deſcription and vſe of the *Sexagenerarie Tables.*

This Table conſiſteth of two figures, whereof the nether figure hauing foure Angles, is called in Latine Trapezium, marked with the Letters A. D. E. B. and the vpper figure is a Triangle, marked with the Letters A. B. C. and each figure containeth particular Columnes of Numbers, ſeruing to find out the product of Aſtronomicall Fractions, being multiplyed one by another, and alſo the quotients of the like Fractions being diuided one by another, and alſo the ſquare rootes of the ſaid Fractions, for which purpoſe, the firſt Columne on the left hand containeth 59. Fractions, counting from 1. ſtanding aboue, and ſo procéeding downeward to 59. and are contained betwixt A. and D. and the foot of the ſaid Trapezium containeth 30. counting from the left hand towards the right, which are contained betwixt D. and E. and the reſt of the numbers to make vp 59. are to be found in the vppermoſt front of the Triangle, procéeding from C. towards A. you haue to note alſo, that in the vttermoſt Columne of the Trapezium on the right hand, the numbers doe procéed downeward from 30. to 59. that is, from B. to E. and the numbers in the outermoſt Columne of the Triangle on the right hand, doe procéede vpward from 31. to 59. contained betwixt B. and C. both which doe ſerue to fill vp the firſt multiplyers, and multiplycands, for when you cannot find them in the Trapezium, then the outermoſt Columne of the Triangle on the right hand ſeruing to ſupply that want, and when you cannot find the ſaid numbers in the Triangle, then the outer-

moſt

Theens in Diuiſion,

A

C

		59	58	57	36	35	34	33	32	31	
		58 1	57 2	56 23	35 24	34 25	33 26	32 27	31 28	30 29	59
			54 4	55 36	34 48	33 50	32 52	31 54	30 56	29 58	58
				54 9	34 12	33 15	32 18	31 21	30 24	29 27	57
1	0 1			2	33 36	32 40	31 44	30 48	29 52	28 50	56
2	0 2	0 4		5	33 0	32 5	31 10	30 15	29 20	27 25	55
3	0 3	0 6	0 9	8	32 24	31 30	30 36	29 42	28 48	27 54	54
4	0 4	0 8	0 12	0 1	31 48	30 53	30 2	29 9	28 16	27 23	53
5	0 5	0 10	0 15	0 2 4	31 12	30 20	29 28	28 36	27 44	26 52	52
6	0 6	0 12	0 18	0 2 27	30 36	29 45	28 54	28 3	27 12	26 21	51
7	0 7	0 14	0 21	0 0	30 0	29 10	28 20	27 30	26 40	25 50	50
8	0 8	0 16	0 24	0 3 3	29 24	28 35	27 45	26 57	26 8	25 19	49
9	0 9	0 18	0 27	0 3 6	28 48	28 0	27 12	26 24	25 36	24 48	48
10	0 10	0 20	0 30	0 4 9	28 12	27 25	26 38	25 51	25 4	24 17	47
11	0 11	0 22	0 33	0 2	27 36	26 50	26 4	25 12	24 32	23 46	6

D

The Sexagenarie Table whereby the Products in Multiplication, the Quotiens in Diuiſion, and the ſquare Rootes are found in Aſtronomicall Fractions.

A

C

		59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	
		58 1	57 2	56 3	55 4	54 5	53 6	52 7	51 8	50 9	49 10	48 11	47 12	46 13	45 14	44 15	43 16	42 17	41 18	40 19	39 20	38 21	37 22	36 23	35 24	34 25	33 26	32 27	31 28	30 29	59
			54 4	55 6	54 8	53 10	52 12	51 14	50 16	49 18	48 20	47 22	[illegible] 24	45 26	44 28	43 30	42 32	41 34	40 36	39 38	38 40	37 42	36 44	35 46	34 48	33 50	32 52	31 54	30 56	29 58	58
				54 9	53 12	52 15	51 18	50 21	49 24	48 27	47 30	46 33	45 36	44 39	43 42	42 45	41 48	40 51	39 54	38 57	38 0	37 3	36 6	34 9	34 12	33 15	32 18	31 21	30 24	29 27	57
1	0 1				52 10	51 20	50 24	49 28	48 32	47 36	46 40	45 44	44 48	43 52	42 56	42 0	41 4	40 8	39 12	38 16	37 20	36 24	35 28	34 32	33 36	32 40	31 44	30 48	29 52	28 50	56
2	0 2	0 4				50 25	49 30	48 35	47 40	46 45	45 50	44 55	44 0	43 5	42 10	41 15	40 20	29 25	38 30	37 35	36 40	35 45	34 50	33 55	33 0	32 5	31 10	30 15	29 20	27 25	55
3	0 3	0 6	0 9			6	48 36	47 42	46 48	45 54	45 0	44 6	43 12	42 18	41 24	40 30	39 36	38 42	37 48	36 54	36 0	35 6	34 12	33 18	32 24	31 30	30 36	29 42	28 48	27 54	54
4	0 4	0 8	0 12	0 16				46 49	45 56	45 3	44 10	43 17	42 24	41 31	40 38	39 45	38 52	37 59	37 6	36 13	35 20	34 27	33 34	32 41	31 48	30 55	30 2	29 9	28 16	27 23	53
5	0 5	0 10	0 15	0 20	0 25				45 4	44 12	43 20	42 28	41 36	40 44	39 52	39 0	38 8	37 10	36 24	35 32	34 40	33 48	32 56	32 4	31 12	30 20	29 28	28 36	27 44	26 52	52
6	0 6	0 12	0 18	0 24	0 30	0 36				43 21	42 30	41 39	40 48	39 57	39 6	38 15	37 24	36 33	35 42	34 51	34 0	33 9	32 18	31 27	30 36	29 45	28 54	28 3	27 12	26 21	51
7	0 7	0 14	0 21	0 9	0 35	0 42	0 49				41 40	40 50	40 0	39 10	38 20	37 30	36 40	35 50	35 0	34 10	33 20	32 30	31 40	30 50	30 0	29 10	28 20	27 30	26 40	25 50	50
8	0 8	0 16	0 24	0 32	0 40	0 48	0 56	1 4				40 1	39 12	38 23	37 34	36 45	35 56	35 7	34 18	33 29	32 40	31 51	31 2	30 13	29 24	28 35	27 46	26 57	26 8	25 19	49
9	0 9	0 18	0 27	0 36	0 45	0 54	1 3	1 12	1 21				38 24	37 36	36 48	36 0	35 12	34 24	33 36	32 48	32 0	31 12	30 24	29 36	28 48	28 0	27 12	26 24	25 36	24 48	48
10	0 10	0 20	0 30	0 40	0 50	1 0	1 10	1 20	1 30	1 40				36 49	36 2	35 15	34 28	33 41	32 54	32 7	31 20	30 33	29 46	28 59	28 12	27 25	26 38	25 51	25 4	24 17	47
11	0 11	0 22	0 33	0 44	0 55	1 6	1 17	1 28	1 39	1 50	2 1				35 16	34 30	33 44	32 58	32 12	31 26	30 40	29 54	29 8	28 22	27 36	26 50	26 4	25 12	24 32	23 46	46
12	0 12	0 24	0 36	0 48	1 0	1 12	1 24	1 36	1 48	2 0	2 12	[illegible]				33 45	33 0	32 15	31 30	30 45	29 0	29 15	28 30	27 45	27 0	26 15	25 30	24 45	24 0	23 15	45
13	0 13	0 26	0 39	0 52	1 5	1 18	1 31	1 44	1 57	2 10	2 23	[illegible]	2 49				32 16	31 32	30 48	30 4	29 20	28 36	27 52	27 8	26 24	25 40	24 56	24 12	23 28	22 44	44
14	0 14	0 2	0 42	0 56	1 10	1 24	1 38	1 52	2 6	2 20	2 34	2 48	3 2	3 16				30 49	30 6	29 23	28 40	27 57	27 14	26 31	25 48	25 5	24 22	23 39	22 56	22 13	43
15	0 15	0 30	0 45	1 0	1 15	1 30	1 45	2 0	2 15	2 30	2 45	3 0	3 15	3 30	3 45				29 24	28 42	28 0	27 18	26 36	25 54	25 12	24 30	23 48	23 6	22 24	21 42	42
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21	0 21	0 42	1 3	1 24	1 45	2 6	2 27	2 48	3 9	3 30	3 51	4 12	4 33	4 54	5 15	5 36	5 57	6 18	6 39	7 0	7 21				21 36	21 0	20 24	19 48	19 12	18 36	36
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23	0 23	0 46	1 9	1 32	1 55	2 18	2 41	3 4	3 27	3 50	4 13	4 36	4 59	5 22	5 45	6 8	6 31	6 54	7 17	7 40	8 3	8 26	8 49				19 16	18 42	18 8	17 34	34
24	0 24	0 48	1 12	1 36	2 0	2 24	2 48	3 12	3 36	4 0	4 24	4 48	5 12	5 36	6 0	6 24	6 48	7 12	7 36	8 0	8 24	8 48	9 12	9 36				18 9	17 36	17 3	33
25	0 25	0 50	1 15	1 40	2 5	2 30	2 55	3 20	3 45	4 10	4 35	5 0	5 25	5 50	6 15	6 40	7 5	7 30	7 55	8 20	8 45	9 10	9 35	10 0	10 25				17 4	16 32	32
26	0 26	0 52	1 18	1 44	2 10	2 36	3 2	3 28	3 54	4 20	4 46	5 12	5 38	6 4	6 30	6 56	7 22	7 48	8 14	8 40	9 6	9 32	9 58	10 24	10 50	11 16				16 1	31
27	0 27	0 54	1 21	1 48	2 15	2 42	3 9	3 36	4 3	4 30	4 57	5 24	5 51	6 18	6 45	7 12	7 39	8 6	8 33	9 0	9 27	9 54	10 21	10 48	11 15	11 42	12 9				
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30	0 30	1 0	1 30	2 0	2 30	3 0	3 30	4 0	4 30	5 0	5 30	6 0	6 30	7 0	7 30	8 0	8 30	9 0	9 30	10 0	10 30	11 0	11 30	12 0	12 30	13 0	13 30	14 0	14 30	15 0	30
31	0 31	1 2	1 33	2 4	2 35	3 6	3 37	4 8	4 39	5 10	5 41	6 12	6 43	7 14	7 45	8 16	8 47	9 18	9 49	10 20	10 51	11 22	11 53	12 24	12 55	13 26	13 57	14 28	14 59	15 30	31
32	0 32	1 4	1 36	2 8	2 40	3 12	3 44	4 16	4 48	5 20	5 52	6 24	6 56	7 28	8 0	8 32	9 4	9 36	10 8	10 40	11 12	11 44	12 16	12 48	13 20	13 52	14 24	14 56	15 28	16 0	32
33	0 33	1 6	1 39	2 12	2 45	3 18	3 51	4 24	4 57	5 30	6 3	6 36	7 9	7 42	8 15	8 48	9 21	9 54	10 27	11 0	11 33	12 6	12 39	13 12	13 45	14 18	14 51	15 24	15 57	16 30	33
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37	0 37	1 14	1 51	2 28	3 5	3 42	4 19	4 56	5 33	6 10	6 47	7 24	8 1	8 38	9 15	9 52	10 29	11 6	11 43	12 20	12 57	13 34	14 11	14 48	15 25	16 2	16 39	17 16	17 53	18 30	37
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39	0 39	1 18	1 57	2 36	3 15	3 54	4 33	5 12	5 51	6 30	7 9	7 48	8 27	9 0	9 45	10 24	11 3	11 42	12 21	13 0	13 39	14 18	14 54	15 36	16 15	16 54	17 33	18 12	18 51	19 30	39
40	0 40	1 20	2 0	2 40	3 20	4 0	4 40	5 20	6 0	6 40	7 20	8 0	8 40	9 20	10 0	10 40	11 20	12 0	12 40	13 20	14 0	14 40	15 20	16 0	16 40	17 20	18 0	18 40	19 20	20 0	40
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43	0 43	1 26	2 9	2 52	3 35	4 18	5 1	5 44	6 27	7 10	7 53	8 36	9 19	10 2	10 45	11 28	12 11	12 54	13 37	14 20	15 3	15 46	16 29	17 12	17 55	18 38	19 21	20 4	20 47	21 30	43
44	0 44	1 28	2 12	2 56	3 40	4 24	5 8	5 52	6 36	7 20	8 4	8 48	9 32	10 16	11 0	11 44	[illegible]	13 12	13 56	14 40	15 24	16 8	16 52	17 36	18 20	19 4	19 48	20 32	21 16	22 0	44
45	0 45	1 30	2 15	3 0	3 45	4 30	5 15	6 0	6 45	7 30	8 15	9 0	9 45	10 30	11 15	12 0	12 45	13 30	14 15	15 0	15 45	16 30	17 15	18 0	18 45	19 30	20 15	21 0	21 45	22 30	45
46	0 46	1 32	2 18	3 4	3 50	4 36	5 22	6 8	6 54	7 40	8 26	9 12	9 58	10 44	11 30	12 16	[illegible]	13 48	14 34	15 20	16 6	16 52	17 38	18 24	19 10	19 56	20 42	21 28	22 14	23 0	46
47	0 47	1 34	2 21	3 8	3 55	4 42	5 29	6 16	7 3	7 50	8 37	9 24	10 11	10 58	11 45	12 32	[illegible]	[illegible]	14 53	15 40	16 27	17 14	18 1	18 48	19 35	20 22	21 9	21 56	22 43	23 30	47
48	0 48	1 36	2 24	3 12	4 0	4 48	5 36	6 24	7 12	8 0	8 48	9 36	10 24	11 12	12 0	12 48	13 36	14 24	15 12	16 0	16 48	17 36	18 24	19 12	20 0	20 48	21 36	22 24	23 12	24 0	48
49	0 49	1 38	2 27	3 16	4 5	5 54	5 45	6 32	7 21	8 10	8 59	9 48	10 37	11 26	12 15	13 4	13 53	14 42	15 31	16 20	17 9	17 50	18 47	19 36	20 25	21 14	22 3	22 52	23 41	24 30	49
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51	0 51	1 42	2 33	3 24	4 15	5 6	5 57	6 48	7 39	8 30	9 21	10 12	11 3	11 54	12 45	13 36	14 27	15 18	16 9	17 0	17 51	18 42	19 33	20 24	21 15	22 6	22 57	23 48	24 39	25 30	51
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53	0 53	1 46	2 39	3 32	4 25	5 18	6 11	7 4	7 57	8 50	9 43	10 36	11 29	12 22	13 15	14 8	15 1	15 54	16 47	17 40	18 33	19 26	20 19	21 12	22 5	22 58	23 51	24 44	25 37	26 30	53

B

The Triangle.

The Trapezium.

The Trapezium.

																43 30	42 32	41 34	40 36	39 38	38 40	37 42	36 44	35 46	34 48	33 50	32 52	31 54	30 56	29 58	58
				54 9	53 12	52 15	51 18	50 21	49 24	48 27	47 30	46 33	45 36	44 39	43 42	42 45	41 48	40 51	39 54	38 57	38 0	37 3	36 6	35 9	34 12	33 15	32 18	31 21	30 24	29 27	57
1	0 1				52 16	51 20	50 24	49 28	48 32	47 36	46 40	45 44	44 48	43 52	42 56	42 0	41 4	40 8	39 12	38 16	37 20	36 24	35 28	34 32	33 36	32 40	31 44	30 48	29 52	28 56	56
2	0 2	0 4				50 25	49 30	48 35	47 40	46 45	45 50	44 55	44 0	43 5	42 10	41 15	40 20	39 25	38 30	37 35	36 40	35 45	34 50	33 55	33 0	32 5	31 10	30 15	29 20	28 25	55
3	0 3	0 6	0 9				48 36	47 42	46 48	45 54	45 0	44 6	43 12	42 18	41 24	40 30	39 36	38 42	37 48	36 54	36 0	35 6	34 12	33 18	32 24	31 30	30 36	29 42	28 48	27 54	54
4	0 4	0 8	0 12	0 16				46 49	45 56	45 3	44 10	43 17	42 24	41 31	40 38	39 45	38 52	37 59	37 6	36 13	35 20	34 27	33 34	32 41	31 48	30 55	30 2	29 9	28 16	27 23	53
5	0 5	0 10	0 15	0 20	0 25				45 4	44 12	43 20	42 28	41 36	40 44	39 52	39 0	38 8	37 16	36 24	35 32	34 40	33 48	32 56	32 4	31 12	30 20	29 28	28 36	27 44	26 52	52
6	0 6	0 12	0 18	0 24	0 30	0 36				43 21	42 30	41 39	40 48	39 57	39 6	38 15	37 24	36 33	35 42	34 51	34 0	33 9	32 18	31 27	30 36	29 45	28 54	28 3	27 12	26 21	51
7	0 7	0 14	0 21	0 28	0 35	0 42	0 49				41 40	40 50	40 0	39 10	38 20	37 30	36 40	35 50	35 0	34 10	33 20	32 30	31 40	30 50	30 0	29 10	28 20	27 30	26 40	25 50	50
8	0 8	0 16	0 24	0 32	0 40	0 48	0 56	1 4				40 1	39 12	38 23	37 34	36 45	35 56	35 7	34 18	33 29	32 40	31 51	31 2	30 13	29 24	28 35	27 46	26 57	26 8	25 19	49
9	0 9	0 18	0 27	0 36	0 45	0 54	1 3	1 12	1 21				38 24	37 36	36 48	36 0	35 12	34 24	33 36	32 48	32 0	31 12	30 24	29 36	28 48	28 0	27 12	26 24	25 36	24 48	48
10	0 10	0 20	0 30	0 40	0 50	1 0	1 10	1 20	1 30	1 40				36 49	36 2	35 15	34 28	33 41	32 54	32 7	31 20	30 33	29 46	28 59	28 12	27 25	26 38	25 51	25 4	24 17	47
11	0 11	0 22	0 33	0 44	0 55	1 6	1 17	1 28	1 39	1 50	2 1				35 16	34 30	33 44	32 58	32 12	31 26	30 40	29 54	29 8	28 22	27 36	26 50	26 4	25 18	24 32	23 46	46
12	0 12	0 24	0 36	0 48	1 0	1 12	1 24	1 36	1 48	2 0	2 12	2 24				33 45	33 0	32 15	31 30	30 45	30 0	29 15	28 30	27 45	27 0	26 15	25 30	24 45	24 0	23 15	45
13	0 13	0 26	0 39	0 52	1 5	1 18	1 31	1 44	1 57	2 10	2 23	2 36	2 49				32 16	31 32	30 48	30 4	29 20	28 36	27 52	27 8	26 24	25 40	24 56	24 12	23 28	22 44	44
14	0 14	0 28	0 42	0 56	1 10	1 24	1 38	1 52	2 6	2 20	2 34	2 48	3 2	3 16				30 49	30 6	29 23	28 40	27 57	27 14	26 31	25 48	25 5	24 22	23 39	22 56	22 13	43
15	0 15	0 30	0 45	1 0	1 15	1 30	1 45	2 0	2 15	2 30	2 45	3 0	3 15	3 30	3 45				29 24	28 42	28 0	27 18	26 36	25 54	25 12	24 30	23 48	23 6	22 24	21 42	42
16	0 16	0 32	0 48	1 4	1 20	1 36	1 52	2 8	2 24	2 40	2 56	3 12	3 28	3 44	4 0	4 16				28 1	27 20	26 39	25 58	25 17	24 36	23 55	23 14	22 33	21 52	21 11	41
17	0 17	0 34	0 51	1 8	1 25	1 42	1 59	2 16	2 33	2 50	3 7	3 24	3 41	3 58	4 15	4 32	4 49				26 40	26 0	25 20	24 40	24 0	23 20	22 40	22 0	21 20	20 40	40
18	0 18	0 36	0 54	1 12	1 30	1 48	2 6	2 24	2 42	3 0	3 18	3 36	3 54	4 12	4 30	4 48	5 6	5 24				25 21	24 42	24 3	23 24	22 45	22 6	21 27	20 48	20 9	39
19	0 19	0 38	0 57	1 16	1 35	1 54	2 13	2 32	2 51	3 10	3 29	3 48	4 7	4 26	4 45	5 4	5 23	5 42	6 1				24 4	23 26	22 48	22 10	21 32	20 54	20 16	19 38	38
20	0 20	0 40	1 0	1 20	1 40	2 0	2 20	2 40	3 0	3 20	3 40	4 0	4 20	4 40	5 0	5 20	5 40	6 0	6 20	6 40				22 49	22 12	21 35	20 58	20 21	19 44	19 7	37
21	0 21	0 42	1 3	1 24	1 45	2 6	2 27	2 48	3 9	3 30	3 51	4 12	4 33	4 54	5 15	5 36	5 57	6 18	6 39	7 0	7 21				21 36	21 0	20 24	19 48	19 12	18 36	36
22	0 22	0 44	1 6	1 28	1 50	2 12	2 34	2 56	3 18	3 40	4 2	4 24	4 46	5 8	5 30	5 52	6 14	6 36	6 58	7 20	7 42	8 4				20 25	[illegible] 50	19 15	18 40	18 5	35
23	0 23	0 46	1 9	1 32	1 55	2 18	2 41	3 4	3 27	3 50	4 13	4 36	4 59	5 22	5 45	6 8	6 31	6 54	7 17	7 40	8 3	8 26	8 49				19 16	18 42	18 8	17 34	34
24	0 24	0 48	1 12	1 36	2 0	2 24	2 48	3 12	3 36	4 0	4 24	4 48	5 12	5 36	6 0	6 24	6 48	7 12	7 36	8 0	8 24	8 48	9 12	9 36				18 9	17 36	17 3	33
25	0 25	0 50	1 15	1 40	2 5	2 30	2 55	3 20	3 45	4 10	4 35	5 0	5 25	5 50	6 15	6 40	7 5	7 30	7 55	8 20	8 45	9 10	9 35	10 0	10 25				17 4	16 32	32
26	0 26	0 52	1 18	1 44	2 10	2 36	3 2	3 28	3 54	4 20	4 46	5 12	5 38	6 4	6 30	6 56	7 22	7 48	8 14	8 40	9 6	9 32	9 58	10 24	10 50	11 16				16 1	31
27	0 27	0 54	1 21	1 48	2 15	2 42	3 9	3 36	4 3	4 30	4 57	5 24	5 51	6 18	6 45	7 12	7 39	8 6	8 33	9 0	9 27	9 54	10 21	10 48	11 15	11 42	12 9				
28	0 28	0 56	1 24	1 52	2 20	2 48	3 16	3 44	4 12	4 40	5 8	5 36	6 4	6 32	7 0	7 28	7 56	8 24	8 52	9 20	9 48	10 16	10 44	11 12	11 40	12 8	12 36	13 4			
29	0 29	0 58	1 27	1 56	2 25	2 54	3 23	3 52	4 21	4 50	5 19	5 48	6 17	6 46	7 15	7 44	8 13	8 42	9 11	9 40	10 9	10 38	11 7	11 36	12 5	12 34	13 3	13 32	14 1		
30	0 30	1 0	1 30	2 0	2 30	3 0	3 30	4 0	4 30	5 0	5 30	6 0	6 30	7 0	7 30	8 0	8 30	9 0	9 30	10 0	10 30	11 0	11 30	12 0	12 30	13 0	13 30	14 0	14 30	15 0	30
31	0 31	1 2	1 33	2 4	2 35	3 6	3 37	4 8	4 39	5 10	5 41	6 12	6 43	7 14	7 45	8 16	8 47	9 18	9 49	10 20	10 51	11 22	11 53	12 24	12 55	13 26	13 57	14 28	14 59	15 30	31
32	0 32	1 4	1 36	2 8	2 40	3 12	3 44	4 16	4 48	5 20	5 52	6 24	6 56	7 28	8 0	8 32	9 4	9 36	10 8	10 40	11 12	11 44	12 16	12 48	13 20	13 52	14 24	14 56	15 28	16 0	32
33	0 33	1 6	1 39	2 12	2 45	3 18	3 51	4 24	4 57	5 30	6 3	6 36	7 9	7 42	8 15	8 48	9 21	9 54	10 27	11 0	11 33	12 6	12 39	13 12	13 45	14 18	14 51	15 24	15 57	16 30	33
34	0 34	1 8	1 42	2 16	2 50	3 24	3 58	4 32	5 6	5 40	6 14	6 48	7 22	7 56	8 30	9 4	9 38	10 12	10 46	11 20	11 54	12 28	13 2	13 36	14 10	14 44	15 18	15 52	16 26	17 0	34
35	0 35	1 10	1 45	2 20	2 55	3 30	4 5	4 40	5 15	5 50	6 25	7 0	7 35	8 10	8 45	9 20	9 55	10 30	11 5	11 40	12 15	12 50	13 25	14 0	14 35	15 10	15 45	16 20	16 55	17 30	35
36	0 36	1 12	1 48	2 24	3 0	3 36	4 12	4 48	5 24	6 0	6 36	7 12	7 48	8 24	9 0	9 36	10 12	10 48	11 24	12 0	12 36	13 12	13 48	14 24	15 0	15 36	16 12	16 48	17 24	18 0	36
37	0 37	1 14	1 51	2 28	3 5	3 42	4 19	4 56	5 33	6 10	6 47	7 24	8 1	8 38	9 15	9 52	10 29	11 6	11 43	12 20	12 57	13 34	14 11	14 48	15 25	16 2	16 39	17 16	17 53	18 30	37
38	0 38	1 16	1 54	2 32	3 10	3 48	4 26	5 4	5 42	6 20	6 58	7 36	8 14	8 52	9 30	10 8	10 46	11 24	12 2	12 40	13 18	13 56	14 34	15 12	15 50	16 28	17 6	17 44	18 22	19 0	38
39	0 39	1 18	1 57	2 36	3 15	3 54	4 33	5 12	5 51	6 30	7 9	7 48	8 27	9 6	9 45	10 24	11 3	11 42	12 21	13 0	13 39	14 18	14 57	15 36	16 15	16 54	17 33	18 12	18 51	19 30	39
40	0 40	1 20	2 0	2 40	3 20	4 0	4 40	5 20	6 0	6 40	7 20	8 0	8 40	9 20	10 0	10 40	11 20	12 0	12 40	13 20	14 0	14 40	15 20	16 0	16 40	17 20	18 0	18 40	19 20	20 0	40
41	0 41	1 22	2 3	2 44	3 25	4 6	4 47	5 28	6 9	6 50	7 31	8 12	8 53	9 34	10 15	10 56	11 37	12 18	12 59	13 40	14 21	15 2	15 43	16 24	17 5	17 46	18 27	19 8	19 49	20 30	41
42	0 42	1 24	2 6	2 48	3 30	4 12	4 54	5 36	6 18	7 0	7 42	8 24	9 6	9 48	10 30	11 12	11 54	12 36	13 18	14 0	14 42	15 24	16 6	16 48	17 30	18 12	18 54	19 36	20 18	21 0	42
43	0 43	1 26	2 9	2 52	3 35	4 18	5 1	5 44	6 27	7 10	7 53	8 36	9 19	10 2	10 45	11 28	12 11	12 54	13 37	14 20	15 3	15 46	16 29	17 12	17 55	18 38	19 21	20 4	20 47	21 30	43
44	0 44	1 28	2 12	2 56	3 40	4 24	5 8	5 52	6 36	7 20	8 4	8 48	9 32	10 16	11 0	11 44	12 28	13 12	13 56	14 40	15 24	16 8	16 52	17 36	18 20	19 4	19 48	20 32	21 16	22 0	44
45	0 45	1 30	2 15	3 0	3 45	4 30	5 15	6 0	6 45	7 30	8 15	9 0	9 45	10 30	11 15	12 0	12 45	13 30	14 15	15 0	15 45	16 30	17 15	18 0	18 45	19 30	20 15	21 0	21 45	22 30	45
46	0 46	1 32	2 18	3 4	3 50	4 36	5 22	6 8	6 54	7 40	8 26	9 12	9 58	10 44	11 30	12 16	13 2	13 48	14 34	15 20	16 6	16 52	17 38	18 24	19 10	19 56	20 42	21 28	22 14	23 0	46
47	0 47	1 34	2 21	3 8	3 55	4 42	5 29	6 16	7 3	7 50	8 37	9 24	10 11	10 58	11 45	12 32	13 19	14 6	14 53	15 40	16 27	17 14	18 1	18 48	19 35	20 22	21 9	21 56	22 43	23 30	47
48	0 48	1 36	2 24	3 12	4 0	4 48	5 36	6 24	7 12	8 0	8 48	9 36	10 24	11 12	12 0	12 48	13 36	14 24	15 12	16 0	16 48	17 36	18 24	19 12	20 0	20 48	21 36	22 24	23 12	24 0	48
49	0 49	1 38	2 27	3 16	4 5	4 54	5 43	6 32	7 21	8 10	8 59	9 48	10 37	11 26	12 15	13 4	13 53	14 42	15 31	16 20	17 9	17 58	18 47	19 36	20 25	21 14	22 3	22 52	23 41	24 30	49
50	0 50	1 40	2 30	3 20	4 10	5 0	5 50	6 40	7 30	8 20	9 10	10 0	10 50	11 40	12 30	13 20	14 10	15 0	15 50	16 40	17 30	18 20	19 10	20 0	20 50	21 40	22 30	23 20	24 10	25 0	50
51	0 51	1 42	2 33	3 24	4 15	5 6	5 57	6 48	7 39	8 30	9 21	10 12	11 3	11 54	12 45	13 36	14 27	15 18	16 9	17 0	17 51	18 42	19 33	20 24	21 15	22 6	22 57	23 48	24 39	25 30	51
52	0 52	1 44	2 36	3 28	4 20	5 12	6 4	6 56	7 48	8 40	9 32	10 24	11 16	12 8	13 0	13 52	14 44	15 36	16 28	17 20	18 12	19 4	19 56	20 48	21 40	22 32	23 24	24 16	25 8	26 0	52
53	0 53	1 46	2 39	3 32	4 25	5 18	6 11	7 4	7 57	8 50	9 43	10 36	11 29	12 22	13 15	14 8	15 1	15 54	16 47	17 40	18 33	19 26	20 19	21 12	22 5	22 58	23 51	24 44	25 37	26 30	53
54	0 54	1 48	2 42	3 36	4 30	5 24	6 18	7 12	8 6	9 0	9 54	10 48	11 42	12 36	13 30	14 24	15 18	16 12	17 6	18 0	18 54	19 48	20 42	21 36	22 30	23 24	24 18	25 12	26 6	27 0	54
55	0 55	1 50	2 45	3 40	4 35	5 30	6 25	7 20	8 15	9 10	10 5	11 0	11 55	12 50	13 45	14 40	15 35	16 30	17 25	18 20	19 15	20 10	21 5	22 0	22 55	23 50	24 45	25 40	26 35	27 30	55
56	0 56	1 52	2 48	3 44	4 40	5 36	6 32	7 28	8 24	9 20	10 16	11 12	12 8	13 4	14 0	14 56	15 52	16 48	17 44	18 40	19 36	20 32	21 28	22 24	23 20	24 16	25 12	26 8	27 4	28 0	56
57	0 57	1 54	2 51	3 48	4 45	5 42	6 39	7 36	8 33	9 30	10 27	11 24	12 21	13 18	14 15	15 12	16 9	17 6	18 3	19 0	19 57	20 54	21 51	22 48	23 45	24 42	25 39	26 36	27 33	28 30	57
58	0 58	1 56	2 54	3 52	4 50	5 48	6 46	7 44	8 42	9 40	10 38	11 36	12 34	13 32	14 30	15 28	16 26	17 24	18 22	19 20	20 18	21 16	22 14	23 12	24 10	25 8	26 6	27 4	28 2	29 0	58
59	0 59	1 58	2 57	3 56	4 55	5 54	6 53	7 52	8 51	9 50	10 49	11 48	12 47	13 46	14 45	15 44	16 43	17 42	18 41	19 40	20 39	21 38	22 37	23 36	24 35	25 34	26 33	27 32	28 31	29 30	59
60	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	

The Triangle.

B

The Trapezium.

The Trapezium.

D

E

moſt Collum of Trapezium on the right hand, ſerueth to ſupply that want, and in ſéeking any multiplyer or multiplicand, either in the Trapezium, or in the Triangle, conſider alwayes which way they are moſt readily found out, ſo as they may directly anſwere one againſt another.

All the reſt of the numbers contayned betwixt the two outermoſt Collums and are downe in ſquare Angles, called common Angles do ſignifie either products, or diuidens, or ſquare numbers according as occaſion ſhall require. And the outermoſt Collums doe ſignifie ſometime multiplyers, ſometime multiplicands, ſometime quotients, and ſometime roots. All which things you ſhall better vnderſtand by the Examples hereafter following.

The vſe of the Table.

By helpe of this Table you may more readily multiply and diuide Aſtronomicall fractions, & alſo find out the ſquare root of ſuch fractions, then by thoſe Rules which I haue heretofore ſet downe according to the doctrine of Gemma Friſius. And firſt, I will ſet downe an Example of Multiplication, then another of Diuiſion, and thirdly, one Example of finding out the ſquare Root of the ſaid Fractions, and let the Example of Multiplication be thus: Suppoſe that you would multiply 29. Degrées, 31′. 50″ 7‴ 30⁗ by 13 degrées, 10′. 35″ 1‴. which you muſt ſet downe in ſuch order as followeth, (that is to ſay) firſt the Denominations, then next vnder them the Multiplicand, and next vnder that the Multiplyer, and vnder them the ſeuerall Products, and loweſt of all the totall ſumme of the ſaid Products.

Here beginning with the firſt number of yͤ multiplier on the right hand, which is ‴. ſay thus, one times 30 is 30. which is to be placed vnder yͤ Denomination of

In.	De	′	″	‴	⁗	v.	vi	vii	Denominations.
	29	31	50	7	30				Multiplicand.
	13	10	35	1					Multiplyer.
				29	31	50	7	30	The 1. Product.
		17	13	34	14	22	30		The 2. Product.
	4	55	18	21	15	0			The 3. Product.
	23	53	51	37	30				The 4. Product.
6	29	9	24	2	31	12	37	30	The totall Sum.

ſeuen,

ſeuen, becauſe the denomination ouer 1. is 3. and the denomination ouer 30. is 4. which being added together according to the Rule before ſet downe in the Chapter of Multiplication of Aſtronomicall Fractions doe make 7. then ſay one times 7. is 7. which you muſt place vnder the firſt denomination. Againe, one times 50. is 50. which is to bee ſet vnder the fift denomination, becauſe 3. and 2. maketh 5. then ſay one times 31. is 31. which is to be ſet vnder the fourth denomination, for 3. and 1. maketh 4. then one times 29. is 29. which is to ſet vnder the third denomination, and thus you haue the firſt product, then proceed with the next Number of the Multiplyer towards your left hand, which is 35. and is to bee multiplyed into 30. which doe readily, you muſt enter the Table with theſe two Numbers, and ſeeking in the firſt Collum of the Trapezium on the left hand, for 35. in the foot of the ſaid Trapezium, for the number of 30. you ſhall finde in the common Angle the product to bee 17. and 30. whereof you muſt place the 30. vnder the firſt denomination, and keeping the number 17. ſtill in minde to bee added to the next product, multiply 35. into 7. and you ſhall finde in the Trapezium, the product to bee 4. and 5. whereunto if you adde the 17. which you had in minde, the product will bee 4. and 22. whereof you muſt ſet the 22. vnder the fift denomination, and keeping the 4. in minde, multiply againe the ſame 35. into 50. the product whereof you ſhall finde in the Triangle to be 29. and 10. whereto if you adde the 4. in minde, it will make 29. and 14. whereof the 14. is to bee placed vnder the fourth denomination, and keeping the 29. in minde, multiply againe the ſaid 35. into 31. and you ſhall finde the product thereof in the Triangle to be 18. and 5. whereunto if you adde 29. in minde, it will make in all 18. and 34. which 34. is to be ſet vnder the third denomination, then keeping 18. in minde, multiply the foreſaid 35. into 29. and you ſhall finde the product thereof in the Trapezium to bee 16. and 55. whereunto if you adde the 18. in minde, the product will be 17. and 13. which 13. is to bee placed vnder the ſecond Denomination, now becauſe you haue gone through all the numbers of the Multiplicand, with the number 35. you muſt place the

the 17. which you had in minde vnder the Denomination of minutes, and ſo hauing ended the ſecond product, proceed to the finding out of the third product by multiplying 10. firſt into 30. the product whereof you ſhall finde in the Trapezium, to be 5. and 0. whereof you muſt ſet the Cypher vnder the fift Denomination, and keeping the 5. in mind, multiply againe 10. into 7. and you ſhall finde the product to bee 1. and 10. whereunto if you adde the 5. in minde, the product will be 1. and 15. whereof you muſt ſet the 15. vnder the fourth denomination, and keeping the one in minde, multiply 10. into 50. and you ſhall finde the product thereof in the Trapezium to be 8. and 20. whereunto if you adde the 1. in minde, it will make 8. and 21. whereof you muſt ſet the 21. vnder the third Denomination, and keeping 8. in minde, multiply 10. into 31. and you ſhall finde the product thereof in the Trapezium to be 5. and 10. vnto which if you adde the 8. in minde, the product will be 5. and 18. whereof ſet downe the 18. vnder the ſecond Denomination, and keeping 5. in minde, multiply 10. into 29. the product whereof you ſhall finde in the Trapezium to bee 4. and 50. whereunto if you adde the 5. in minde, the product will be 4. and 95. Now becauſe you haue gone through all the Numbers of the Multiplicand with 10. you muſt ſet downe the 4. which you had in minde vnder the Denomination of Degrees, and ſo hauing the third product, proceed to the fourth by multiplying 13. into 30. and you ſhall finde the product in the Trapezium to be 6. and 30. whereof ſet downe 30. vnder the fourth Denomination of Fractions, and keeping 6. in minde, multiply 13. into 7. the product whereof you ſhall find in the Trapezium to bee 1. and 31. whereunto if you adde the 6. in minde, the product will be 1. and 37. whereof ſet downe the 37. vnder the third Denomination, and keeping the 1. in minde, multiply 13. into 50. and you ſhall find the product in the Trapezium to bee 10. and 50. whereunto if you adde the one in minde, the product will bee 16. and 51. whereof ſet the 51. vnder the ſecond Denomination of Fractions, and keeping 10. in minde multiply 13. in 31. the product whereof you ſhall finde in the Trapezium to be 6. and 43. whereunto if you adde the 10. in

minde,

minde the product will bee 6. and 53. whereof ſet downe 53. vnder the firſt denomination of Fractions, and kéeping 6. in minde multiply 17. into 29. the product whereof you ſhall finde in the Trapezium to be 6. and 17. whereunto if you adde the 6. in minde, the product will be 6. and 23. whereof ſet downe 23. vnder the denomination of degrées. Now becauſe you haue gone through all the Numbers of the Multiplicand with the laſt number of the multiplyer, you muſt ſet downe the 6. which you had in minde vnder the denomination of Integrums, that done, adde all the foure products together, beginning on the right hand, ſaying thus, 30. and 0. is but 30. which ſet downe vnder the nethermoſt line, as you ſée in the former figure, then ſay 30. and 7. maketh 37. which you muſt ſet downe vnder the nethermoſt line next vnto 30. then ſay 22. and 50. maketh 72. out of which by ſubtracting the Sexagenary number, the remaynder is $\overset{v}{12}$. which is to be ſet vnder the line next vnto the 37. kéeping ſtill the 60. in minde, which in this account maketh but one, and is to bée added to the next ranke on the left hand; then ſay 1. in minde and 5. maketh 6. and 4. maketh 10. and 1. maketh 11. héere ſet downe 1. and kéepe the Article in minde, then ſay 1. in mind and 3. maketh 4. then 1. and 1. and 3. being added to 4. doe make in all 9. out of which 9. you muſt ſubtract 6. which is but one 60. and is to bée kept in minde and there remayneth 3. which is to be ſet downe by the 1. then ſay 1. in mind and 7. is 8. and 1. is 9. and 4. is 13. and 9. is 22. héere ſet downe 2. and kéepe the two Articles in minde, then ſay 2. and 3. maketh 5. and 2. is 7. and 3. is 10. and 2. maketh 12. tens, which doe make 2. ſixties, and are to be kept in mind, then ſay 2. and 1. maketh 3. and 8. maketh 11. and 3. maketh 14. wherefore ſet downe 4. kéeping the 1. Article in minde, then ſay 1. in minde and 5. is 6. and 1. is 7. and 1. is 8. then take 6. from 8. and there remayneth 2. which ſet downe by the 4. and kéepe one ſixty in minde, then ſay 1. in minde and 3. is 4. and 5. is 9. and 7. is 16. wherefore ſet downe 6. and kéeping one in minde, ſay that 1. and 5. is 6. and 5. is 11. and 1. is 12. which maketh two ſixties to bee kept in minde, then ſay 2. in minde and 3. is 5. and 4. maketh 9. which ſet downe, then

Then ſay 2. is 2. which ſet downe by the 9. vnder the denomination of degrées, then ſay 6. and nothing maketh 6. which ſet downe vnder the denominations of Integrums, for that 6. in this place ſignifieth 6. ſixties, which is in value 360. degrées, and being diuided by 30. becauſe 30. degrées maketh one whole ſigne, you ſhall finde in the quotient 12. ſignes, ſo as the totall ſumme of the foure products is 12. ſignes, 29. degrées, $6'.\overset{''}{24}.\overset{'''}{2}.\overset{''''}{31}.\overset{v}{12}.\overset{vi}{37}.\overset{vii}{30}.$ as the former Example ſheweth, and this is the very ſame Example which I wrought before when I taught you how to multiply Aſtronomicall Fractions according to Gemma Friſius his Rule, and they both doe wholly agrée in euery condition, ſauing that to worke by the Sexagenarie Table is the readier way of the two.

An Example how to diuide Aſtronomicall Fractions. by helpe of the Sexagenarie Table.

SUppoſe then that you would diuide the former totall Summe or product found by Multiplication, which is 6. Integrums 29. degrées $6'.\overset{''}{24}.\overset{'''}{2}.\overset{''''}{31}.\overset{v}{12}.\overset{vi}{37}.\overset{vii}{30}.$ by this diuiſor 29. degrées, $\overset{'}{31}.\overset{''}{50}.\overset{'''}{7}.\overset{''''}{29}.$ which in the former Example of Multiplication, was the Multiplicand. Now to diuide theſe two Numbers the one by the other, you muſt doe thus, firſt, you muſt ſet downe the row of Denominations, as you did before in Multiplication, and next vnder that the Diuidend, then right vnder that the Diuiſor, and on the right hand behind a crooked line made like a halfe Moone, all the ſeuerall quotients are to bee ſet one by another in a right line, as you may ſée by the figures héereafter following.

Héere hauing made your rowe of denominations, & ſet downe your Diuidend, you haue to conſider whether the firſt Number of your Diuiſor, bée greater then the firſt Number of your Diuidend, for if it bée, then you muſt place your Diuiſor one ſpace further towards your

Denomination	In.	De	′	″	‴	⁗	v	vi	vii
The diuidend.	6	29	6	24	2	31	12	37	30
The Diuiſor.		29	31	50	7	29			

your right hand, as in this Example, becauſe the firſt Number of your Diuiſor 29. cannot be taken out of 6. you ſet it vnder ŷ ſecond Number of the diuidend; and ſo all the reſt of the Numbers ſucceſſiuely towards the right hand, as the former Example ſheweth. Now the order of working is thus: You muſt firſt ſeeke out the firſt Number of your Diuiſor, in the firſt Collum of the Trapezium on the left hand, which is 29. then in the row right againſt that 29. on the right hand, you haue to ſeeke out thoſe Numbers of the Diuidend, which do ſtand right ouer the firſt Number of your diuiſor, which is 6. and 29. and if you cannot finde thoſe Numbers iuſtly, then ſeeke in the ſelfe-ſame row a Number, which is ſomewhat leſſe and neereſt in value vnto it, as in this Example, becauſe you cannot find 6. and 29. you take 6. and 17. the quotient whereof you ſhall finde in the foote of the Trapezium right vnder the ſaid Number 6. and 17. to be 13. degrees which you muſt ſet in the quotient Line, and that is your firſt quotient, hauing his proper denomination ouer his head, which are degrees; and are to bee found by the Rule before taught. Thus you ſee heere that the Number of the diuiſor is to be found in the outermoſt Collum on the left hand, and the Number of the diuidend in that row which is right againſt the ſaid Diuiſor, and the quotient in the foot of the Trapezium, right vnder the Number of the diuidend laſt found. Then you haue to multiply the whole Diuiſor (that is to ſay) euery particular Number thereof by the firſt quotient 13. which you may doe by helpe of the Table, as you did before in the Example of Multiplication; and is to bee ſet downe in this manner. And you ſhall finde the whole product to be 6.23.53.51.37.30.

29.31.50.7.30.
13.

Which being ſet right vnder the firſt diuidend, is to be ſubtracted out of the ſame, and the remaynder to be written ouer the head of the diuidend, as you doe in common diuiſion, firſt then to multiply all the particular Numbers of the Diuiſor by the quotient 13. and to find euery product thereof, reſort to the Table and ſeeke for 13. in the foot of the Trapezium, and for 30. which is the Multiplicand in the outermoſt Collum of the Trapezium, on the left hand, and the common Angle will ſhew the Product which is 6. and 30. whereof you muſt ſet downe 30. vnder 30. and keeping 6. in minde, multiply againe 13. into 7. the product whereof you ſhall find to be 1. and 31. vnto which adde the 6. which you kept in minde, and the Product ſhall bee 1. and 37. where you muſt ſet down 37. and keeping one in mind, multiply againe 13. into 50. and you ſhall find the product to be 10. and 50. whereunto if you adde 1. in mind, the product ſhal be 10. & 51. wherof you muſt ſet down 51. & keeping 10. in mind, multiply 13. into 31. the product whereof you ſhall find in the Trapezium to be 6. & 43. whereunto if you adde the 10. ẇ you had in minde, the product ſhall be 6. and 53. whereof ſet downe 53. and keeping 6. in minde, multiply 13. into 29. and you ſhall find the product to bee 6. and 17. whereunto if you adde the 6. in mind, the product ſhall be 6. and 23. whereof ſet downe 23. vnder the laſt Number of your Multiplicand, and becauſe you haue no more Numbers of the Diuiſor to bee multiplyed, ſet downe 6. in minde on the left hand, ſo ſhall the whole Product be 6.23.53.51.37.30. as the former Example ſheweth, which product is to be ſubtracted out of the firſt diuidend, and the remaynder is to bee ſet downe ouer the head of that diuidend, as you ſee in this Example next following, wherein the firſt diuidend is firſt ſet down, and right vnder that the foreſayd Product, which is, the firſt Product, and the remaynder aboue the diuidend, and the quotient 13. is ſet in the quotient line, which is your firſt quotient.

	29	31	50	7	30	The Diuiſor.
					13	The 1. quotient.
6	23	53	51	37	30	The 1. Product.

The remaynder.		5	12	32	25	1				
The firſt diuidend.	~~6~~	~~29~~	~~6~~	~~24~~	~~2~~	~~31~~	12	37	20	(13.
The firſt product.	~~6~~	~~23~~	~~53~~	~~51~~	~~37~~	~~30~~				

And remember (in making you Subtraction) to begin with the firſt Number of the foreſaid product which is on the right hand, and when you cannot take it out of the Number ſtanding right ouer his head, to borrow alwaies 60. of the next number, on the left hand, and to pay it home againe with 1. for there 60. is but 1. This done, remoue your Diuiſor one ſpace further towards the right hand (that is to ſay) ſet the firſt Number of your Diuiſor vnder 12. which is the ſecond Number of the ſecond diuidend, which together with the firſt remainder is 5.12.32.25.1.12.37.30. and all other Numbers of the Diuiſor orderly towards your right hand, as you ſée in this Example.

The ſecond Diuidend.	5	12	32	25	1	12	37	30
The Diuiſor.		29	31	50	7	30		

Then aſke how many times 29. is in 5. & 12. which number you muſt ſéeke in the Trapezium in the rowe that anſwereth towards the right hand, to the firſt Number of your Diuiſor which is 29. ſtanding in the outermoſt Collum of the Trapezium on the left hand; and becauſe you cannot finde 5. & 12. in that row, you muſt take in the ſame row the Number which is nigheſt vnto it, but leſſe, which you ſhall finde to bee 4. and 50. and right vnder that in the foote of the Trapezium you ſhall find 10. which muſt be your ſecond quotient, by which quotient you haue to multiply all the particular Numbers of the Diuiſor, in ſuch order as is before ſet downe, and you ſhall find the product of that Multiplication to be 4.55.18.21.15.0. which product you muſt place vnder the ſecond Diuidend, ſetting 4. vnder 5. and 55. vnder 12. and ſo forth, orderly towards the right hand, that done, ſubtract the ſame product out of the Numbers of the ſecond Diuidend, ſtanding right ouer the ſaid product, and the remaynder will bee 17.14.3.46.12. as you ſée in this Example.

The remaynder.		17	14	3	46	12	37	30	
The ſecond Diuidend,	~~5~~	~~12~~	~~32~~	~~25~~	~~1~~	~~12~~	~~37~~	~~30~~	(13.10.
The ſecond product,	~~4~~	~~55~~	~~18~~	~~25~~	~~15~~	~~0~~			

Now remoue your Diuiſor one ſpace further towards the right hand by ſetting the firſt Number of your Diuiſor, which is 29. vnder 14. which is the ſecond Number of the third Diuidend, and ſo all the reſt orderly towards the right hand, as you ſée in this Example.

Then

The third Diuidend.	17	14	3	46	12	37	30
The Diuiſor.		29	31	50	7	30	

Then aſke how many times 29. is contained in 17. and 14. which Diuidend, becauſe you cannot find it in the row that anſwereth to that 29. which ſtandeth in the outermoſt Columne of the Trapezium, on the left hand (for all thoſe numbers are too little) you muſt ſéeke for it in that Columne which ſtandeth right vpon 29. in the foot of the Trapezium, neyther ſhall you find it there, but you ſhall find 16. and 53. which is ſomewhat leſſer, yet in value nigheſt vnto 17. and 14. and right againſt that, you ſhall find in the outermoſt Columne on the right hand, 35. which muſt be your third quotient, to be ſet in the quotient line, whereby you haue againe to multiply the whole Diuiſor in ſuch order as before, the product whereof you ſhal find to be 17.13.34.14.22.30. which product being placed vnder the Diuidend, by ſetting 17. vnder 17. and 13. vnder 14. and ſo forth orderly towards the right hand, ſubtract the ſaid product (beginning at the right hand) out of the numbers which ſtand right ouer the ſaid product, and the remainder will be 29.31.50.7.30. which is to be ſet downe ouer the third Diuidend, and the reſt to be cancelled, as you ſée in this example.

The remainder.			29	31	50	7	20	
The 3. diuidend.	~~17~~	~~14~~	~~3~~	~~46~~	~~12~~	~~37~~	~~30~~	(13.10.35.
The 3. product,	~~17~~	~~13~~	~~34~~	~~14~~	~~22~~	~~30~~		

And now the remainder of the third Diuidend is come to be the fourth Diuidend: wherfore remoue your Diuiſor one ſpace further towards the right hand, by ſetting 29. vnder 29. and the reſt orderly towards the right hand, as you ſée in the example following: then aſke how many times 29. is contained in 29. which being but once, your fourth quotient is 1. and is to be ſet in the quotient line. whereby the whole Diuiſor being multiplyed, the product will be 29.31.50.7.30. which you muſt place vnder the fourth Diuidend, & being ſubtracted out of the ſame, nothing will remaine, and ſo the whole quotient will be 13. degrées 10′. 35″. 1‴. as you ſée in this example.

The

	0	0	0	0	0	
The fourth Diuidend.	29	31	50	7	30	
The fourth Product.	29	31	50	7	30	

Degr. ′ ″ ‴
(13. 10. 35. 1.

Another example of Diuiſion.

IF the daily motion of the Moone be 13. degrées 3′. 53″. 56‴. 23⁗. 58. in what time ſhall ſhe make her whole reuolution, allowing 360. degrées to that reuolution, which is otherwayes called the Moneth of Peragration. Here, for ſo much as this example is to be wrought by Diuiſion, and that your Diuidend is a ſimple and whole Number (that is to ſay) 360. degrées, without any Fractions of diuers denominations annexed thereunto: you muſt firſt ſet downe the 360. degrées, and next to that, towards your right hand, ſet downe a long row of Cyphers, with ſo many denominations ouer their heads as you ſhall thinke néedfull to ſerue your turne, and right vnder your Diuidend ſet your Diuiſor, as you ſée in this example.

The Denominations.	Inte	De.	′	″	‴	⁗	v	vi	vii	viii	ix
The Diuidend.		360	0	0	0	0	0	0	0	0	0
The Diuiſor.		13	3	53	56	23	58				
The 1. product.		352	45	16	22	47	6				

(27.

Here you firſt muſt aske how many times 13. is in 360. and by the common rule of Diuiſion you ſhall find the quotient to be 27. which you muſt ſet downe in the quotient line, and by that quotient you haue to multiply euery particular number of the Diuiſor, beginning on the right hand, as you doe in Multiplication, ſaying, that 27. times 58. is 26. and 6. as the Trapezium ſheweth, for by ſeeking 27. in the foot of the Trapezium, and for 58. in the outermoſt Columne on the right hand, you ſhall find in the common Angle 26. and 6. wherefore ſet downe 6. vnder 58. and kéeping 26. in mind, multiply 23. which is the ſecond number of the Diuiſor by 27. and by the Trapezium you ſhall find the product thereof to be 10. and 21. whereunto if you adde the 26. in mind, it will make 10. and 47. whereof ſet downe

47.

47. vnder 23. and kéeping 10. in mind, multiply 56. which is the third number of the Diuiſor by 27. and in the Trapezium you ſhall find the product to be 25. and 12. whereto if you adde the 10. in mind, it will make 25. and 22. whereof ſet downe 22. vnder 56. and kéeping 25. in mind, multiply 53. which is the fourth number of the Diuiſor by 27. the product whereof you ſhal find by the Trapezium to be 23. and 51. whereto if you adde 25. in mind, it will make 76. which is one 60. & 16. whereof ſet downe 16. vnder 53. and adde the one in mind to 23. and that wil make 24. which you muſt kéepe in mind, then multiply 3. which is the fift number of the Diuiſor by 27. the product whereof you ſhall find in the Trapezium to be 1. and 21. whereto if you adde the 24. in mind, it will make 1. and 45. whereof ſet downe 45. vnder 3. and kéeping one in mind, multiply 13. which is the laſt number of the Diuiſor by 27. the product whereof, you ſhall find in the Trapezium to be 5. and 51. whereunto if you adde one in mind, it will make 5. and 52. here becauſe the firſt 5. is 5. ſixties, it maketh in all 352. and is to be ſet vnder 360. ſo as the firſt product of this Multiplication containeth theſe numbers, 352. 45. 16. 22. 47. 6. as you ſée them ſet downe in the former example, and this product is to be ſubtracted out of 360. which is the firſt Diuidend. And to auoid confuſion, it ſhall not be amiſſe to ſet downe the firſt Diuidend and the firſt product apart by themſelues thus.

The 1. remainder.	7	14	43	37	12	54	0	0	0
The 1. Diuidend.	360	0	0	0	0	0	0	0	0
The 1. Product.	352	45	16	22	47	6			

(27.

Here beginning on the right hand, ſay thus, take 6. out of nothing, which will not be, wherefore you muſt borrow 60. then by taking 6. out of 60. there will remaine 54. which you muſt ſet aboue that Cypher which ſtandeth right ouer 6. and cancell the 6. kéeping ſtill the one 60. which you borrowed in mind, then ſay 47. and one in mind maketh 48. which will not be taken out of nothing, and therefore you muſt borrow againe one 60. as you did before, ſo ſhall the remainder be 12. which is to be ſet aboue the Cypher which ſtandeth right ouer

47. and

47. and canceld 47. and ſo proceed with like order in ſubtracting all the reſt of the numbers of the firſt product out of the firſt Diuidend, ſo ſhall the remainder be 7.14.43.37.12.54. as you ſee them ſet downe in the former figure. Now hauing to remoue your Diuiſor one ſpace further towards the right hand, you ſhal do well to make your firſt remainder, which is, 7.14.43.37.12.54. to be your ſecond Diuidend, and vnder that to ſet your Diuiſor, as you ſee in this example.

The 2. Diuidend.	7	14	43	37	12	54	0	0	0	(27. 33.
The Diuiſor.		13	3	53	56	23	58		–	

Then aſke how many times 13. is contained in 7. and 14. and hauing found 13. in the foot of the Trapezium, ſeek in ẏ Columne for 7. and 14. and not finding it there, take in the ſelfe-ſame Columne that number which is nigheſt in value vnto it, and leſſe, which you ſhal find to be 7. and 9. right againſt which, in the outermoſt Columne on the right hand, is 33. which muſt be your ſecond quotient, and is to be ſet in the quotient line, next vnto 27. and by this quotient you haue to multiply euery number of the Diuiſor as you did before, the product whereof you ſhal find to be 7.11.8.40.1.10.54. wherfore you muſt firſt ſet downe your ſecond Diuidend, and then the ſecond product right vnder the ſame, as you ſee in this example.

The ſecond remainder.		3	34	57	11	43	6				
The 2. diuidend.	~~7~~	~~14~~	~~43~~	~~37~~	~~12~~	~~54~~	~~0~~	0	0	0	(27. 33.
The 2. product.	~~7~~	~~11~~	~~8~~	~~40~~	~~1~~	~~10~~	~~54~~				

Which product being ſubtracted out of the ſecond Diuidend, the remainder will be 3.34.57.11.43.6. which is to be ſet aboue the ſecond Diuidend, and the product to be cancelled, as you ſee in the former example. Here hauing to remoue againe your common Diuiſor one ſpace further towards the right hand, ſet downe firſt the laſt remainder, which now muſt be your third Diuidend, and vnder that ſet the common Diuiſor, as you ſee in this example.

The 3. diuidend.	3	34	57	11	43	6	0	0	0	
The Diuiſor.		13	3	53	56	23	58			(27. 33. 16.

Then

Then aſke how many times 13. is contained in 3. and 34. here by ſeeking in the foot of the Trapezium for 13. though you cannot find in that Columne 3. and 34. yet you ſhall find 3. and 28. which is the nigheſt, right againſt which, in the outermoſt Columne on the left hand, you ſhall find 16. which muſt be your third quotient, and is to be ſet in the quotient line, by which quotient you muſt multiply the whole Diuiſor as before, the product whereof you ſhall find to be 3.29.2.23.2.23.28. which being the third product, you muſt ſet downe vnder the third Diuidend which was your laſt remainder, and to be ſubtracted out of the ſame, as you ſee in this example.

The third Diuidend.		5	54	48	40	42	32	0	0
	~~3~~	~~34~~	~~57~~	~~11~~	~~43~~	~~6~~	~~0~~	~~0~~	~~0~~
The third product.	3	29	2	23	2	23	28		

And ſo the remainder will be 5. 54. 48. 40. 42. 32. which you muſt ſet aboue the third Diuidend, and all the inferior numbers are to be cancelled, as you ſee in the former example. Here hauing againe to remoue your Diuiſor one ſpace further towards your right hand, the laſt remainder muſt be your fourth Diuidend, vnder which the common Diuiſor is to be ſet thus.

									daies	'	''	'''
The 4. Diuidend.	7	54	48	40	42	32	0	0				
The Diuiſor.		1	3	53	56	23	58		(27	33	16	26

Here aſking how many times 13. is contained in 5. and 54. ſeeke for 13. in the foot of the Trapezium, in whoſe Columne you ſhall not find 5. and 54. but 5. and 51. which is nigheſt vnto it, and right againſt that, in the outermoſt Columne on the left hand, you ſhall find the quotient to be 27. by which if you ſhould multiply the whole Diuiſor, the whole product thereof would be 5.56.21.24.1.47.6. which is more then the Diuidend, and therefore you muſt make your quotient one leſſe, ſetting downe no more but 26. in the quotient line, by which if you multiply the Diuiſor, the product will be 5.26.41.22.25.14.8. which being ſubtracted out of the fourth Diuidend, the remainder will be 28. 7. 18. 17. 52. which remainder if you will

you

you may make to be a fifth Diuidend, and then to worke as before, if you would haue your quotient to extend to ſmaller denominations, which I leaue to do, becauſe I thinke that thirds be ſmall inough. And as often as the product of any particular quotient ſhall be greater then the Diuidend, remember to take a leſſe quotient, euen as you do in common Diuiſion. But now you haue to note, that though this whole quotient here ſignifieth time, for the firſt quotient ſignifieth dayes, the ſecond quotient minutes of dayes, the third quotient ſeconds, & the fourth quotient thirds: yet for ſo much as the day is to be counted by 24. houres, and not by minutes, you muſt therefore reduce all the particular quotients, ſauing the firſt, into houres and parts of houres, euen to ſo ſmall denominations as you ſhall thinke good your ſelfe, by helpe of this Rule, which in Diuiſion of Aſtronomicall Fractions, biddeth to multiply the quotient by 2. and to diuide the product thereof by 5. As here, if you multiply the 33. which is the ſecond quotient by 2. the product will be *66.* which being diuided by 5. the quotient will bee 13. houres, and one *60.* remaining to be kept in mind: wherefore ſet downe in the place of 3′3. 13. houres, then multiply the third quotient, which is 16. by 2. and that will make 32. whereunto if you adde the one 60. in mind, it will make in all *92.* which being diuided by 5. the quotient will be 18. and two ſixties, which is 120: remaining to be kept in mind: wherefore in ſtead of 16″. which was the third quotient, ſet 18′. of an houre, and then proceed to the fourth quotient, which is $\overset{\prime\prime\prime}{26}$. which being multiplyed by 2. maketh 25. whereunto if you adde 120. it will make 172. which if you diuide by 5. the quotient will be 3″4. of an houre; which is to be ſet downe in the place of 26. ſo ſhall your whole former quotient containe 27. dayes, 13. houres, 1′1. of an houre, and 3″4. of an houre. And note, that as in the Diuiſion of Aſtronomicall Fractions, to bring the quotients to like denomination, you doe multiply by 2. and diuide by 5. ſo in Multiplication, to reduce the numbers of the multiplyer, being of diuers denominations, to one ſelfe denomination, you muſt by order reuerſe, multiply by 5. and diuide by 2. whereof I haue giuen you an example before, whereas

whereas I ſhew you how to multiply Aſtronomicall Fractions, according to Gemma Friſius, without the helpe of the Sexagenarie Table.

An Example ſhewing how to extract the ſquare root out of Aſtronomicall Fractions, by helpe of the Sexagenarie Table.

SVppoſe the number giuen to be $1'7.\ \overset{\prime\prime}{12}.\ \overset{\prime\prime\prime}{33}.\ \overset{\prime\prime\prime\prime}{4}.$ whereof you haue to take the ſquare root, here hauing ſet downe the ſaid numbers, with the proper denominations ouer their heads, as you ſee in the example following, firſt ſet a pricke vnder the laſt number on the right hand, & then prick euery other number, leauing one void ſpace betwixt euery two prickes, as you do when you ſeeke the ſquare root of whole Numbers or Integrums, as you ſee here in this example.

The number giuen, $\overset{\prime}{17}.\ \overset{\prime\prime}{12}.\ \overset{\prime\prime\prime}{33}.\ \overset{\prime\prime\prime\prime}{4}.$

Then reſort to the Table, and ſeeke amongſt the products which are placed next to the line A.B. as well in the Trapezium, as in the Triangle, & ſee whether you can find the number ſtanding ouer the firſt prick on the left hand, which is 17. and 12. but not finding it there, you muſt take that which is nigheſt vnto it, and leſſe, which you ſhall find in the Triangle towards B. to be 17.4. the root whereof you ſhal find both in the head, and alſo in the outward Columne of the Triangle on the right hand to be 32. anſwering to the foreſaid ſquare root, which root you muſt place behind the quotient line, then ſubtract 17. and 4. out of 17. and 12. and there will remaine 8. which is to be ſet ouer 12. and the 17. & 12. to be cancelled, that done, double the root 32. which will be 64. that is to ſay, 1. and 4. and ſetting 1. vnder 8. and 4. vnder 33. aske how many times 1. is in 8: and there is 8. which is the ſecond quotient, by which you muſt multiply 1. and 4. the product whereof will be 8. and 32. which being ſubtracted from the vpper number, which is 8. and 33. the remainder is 1. which is to be ſet ouer 33. and the 8. and 33. to be cancelled. Finally, multiply the ſecond quotient 8. in it ſelfe, and the product wil be 1. and 4. which being ſubtracted out of the former remainder of the

the giuen Number nothing remayneth, ſo you ſhall find 3'2.8'. to be the root of the giuen Number, as this Example ſheweth.

Which roote if you multiply into it ſelfe ſquarely, the product will be like vnto the Number giuen, and by this meanes you ſhal find the giuen Number to bee a iuſt ſquare Number. But you haue to note that if the laſt Denomination ſtanding on the right hand be odde and not euen, as thirds or fifts, then you muſt ſet downe a Cypher beyond the laſt denomination towards your right hand, and vnder that Cypher ſet your firſt pricke, as in this Example $3'.\overset{''}{8}.\overset{'''}{9}.\overset{''''}{17}.\overset{v}{3}.$ here becauſe the laſt denomination on the right hand is odde, that is to ſay fifts, you muſt therefore ſet downe next vnto it towards the right hand a Cypher hauing ouer his head the next denomination which is vi. and is euen, wherefore ſet your firſt pricke vnder that Cypher and ſo procéed towards your left hand pricking euery other Number, and then worke as followeth.

$$\begin{array}{l} \quad\overset{''}{\cancel{8}}\ \ \overset{'''}{\cancel{1}} \\ {}'\cancel{1}\cancel{7}.\cancel{1}\cancel{2}.\cancel{3}\cancel{3}.\overset{''''}{\cancel{4}}.\ \ (3'2.8''. \\ \quad\cancel{1}\ \ \cancel{4}\ 4 \\ \quad 1. \end{array}$$

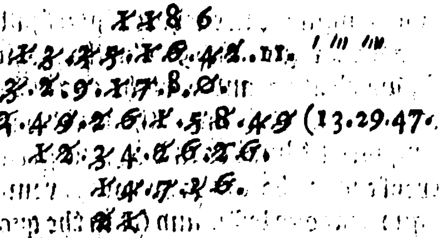
First then ſéeke in the Table amongſt the ſquare Numbers nigh vnto the Line A.B. for 3. & 2. which ſhould ſtand in one ſelf ſquare Angle next vnto the line A.B. for thoſe onely are ſquare Numbers, & not finding it amongſt the ſquare Numbers, take that ſquare which is nigheſt vnto it and leſſe, which you ſhall find to be 2. and 49. the Root whereof is 13. and is to bee found as well in the foote of the Trapezium right vnder the fore-ſaid ſquare Number, as alſo in the outermoſt Collum of the ſaid Trapezium on the left hand ſtanding right againſt the ſame ſquare Number, which root is to be ſet in the quotient line, that done, ſubtract the foreſaid ſquare Number, out of the Number ſtanding right ouer the laſt pricke on the left hand which is 3. and 2. and the remaynder will be 13. which is to be ſet ouer 2. and the 3. & 2. to be cancelled, as you ſée in the former example, that done, double the foreſaid found Root 13. which will make 26. by which you haue to diuide 13. & 9. wherefore reſort to the Trapezium, in the foot whereof you ſhall finde 26. in whoſe Collum not finding 13. and 9. take that which is nigheſt vnto it and leſſe, which is 13. and 0. right againſt which you ſhall finde in the outermoſt Collum on the right hand 30. which ſhould bée your quotient, but becauſe it is too great, and that the Square thereof cannot be taken out of the remaynder, you muſt make the quotient one leſſe, and ſet in the quotient Line no more but 29. by which 29. if you multiply 26. the product will be 12. and 34. as the Trapezium ſheweth, which being ſubtracted out of 13. and 9. ſtanding ouer 26. the remaynder will bee 35. which 35. is to be ſet ouer 9. then by multiplying the ſecond quotient, which is 29. into it ſelfe, you ſhall finde by the Trapezium the product to be 14. and 1. which being ſubtracted out of 35. and 17. the remaynder will be 21. and 16. which is to be ſet ouer 35 and 17, as you ſée in this Example.

$$\begin{array}{l} \quad\overset{''}{\ } \\ \quad 13.\ {}^{'''}\ {}^{''''}\ {}^{v}\ {}^{vi} \\ \cancel{3}.\cancel{2}.9.17.8.0.\ \ (13. \\ 2.42.\ \ \dot{}\ \ \dot{} \end{array}$$

That done, double both the quotients or whole Roote, and the product will be 26.58. and hauing ſet 58. vnder 8. and 26. vnder 16. diuide 21.16. and 8. by 26.58. Wherefore looke for 26. in the foot of Trapezium, and for 21. 16. in that Collum, and not finding it there, take that which is nigheſt vnto it and leſſe, which you ſhall find to be 21. and 14. and right againſt that in the outermoſt Collum on the right hand ſtandeth 49. which being too great to be your quotient by 2. therefore make your quotient no more but 47. which being ſet downe in the quotient line, multiply therby 26.58. and the product will be 21.7.26. which being ſubtracted out of 21.16. and 8. the remaynder will be 8. and 42. then ſetting 42. ouer 8. and 8. ouer 16. cancell 21. 16. and 8. then multiply 47. into it ſelfe ſquarely, and you ſhall find the product thereof in the Triangle to be 36.49. which being ſubtracted out of 8.42. and 0. the remaynder will be 8.6.11 as you ſée in this Example.

$$\begin{array}{ll} \quad 21 & \\ \cancel{1}\ \cancel{3}\ \cancel{3}\ \cancel{5}\ 16 & \\ \cancel{3}.\cancel{2}.\cancel{9}\ \cancel{1}.\cancel{7}.8.0. & (13.\ 29. \\ \cancel{2}\ \cancel{4}\ \cancel{9}\ 26 & \text{The double of the 1. Quo.} \\ \quad 14.1 & \text{The Square of the 2. Quo.} \end{array}$$

And thus you haue found the root of your giuen Number to bee 13.29. and 47. and whether you haue done rightly or not you may know by multiplying the ſaid Roote into it ſelfe ſquarely, and by adding to the product thereof the remaynder, and if you would find a more exact root, then adde more Cyphers to your giuen number towards your right hand, together with their Denominations ouer their heads, as they increaſe ſucceſſiuely, and bee ſure alwayes that the Numbers of the Cyphers be euen and not odde, as 2, 4, 6, and ſo forth, and the more Cyphers that you adde to the giuen Number (ſo as the Number of them be euen) the more exact Root you ſhall haue.



Now to giue to euery Number of the Root his proper Denomination, do thus, take halfe of thoſe Denominations that are ouer euery pricke, and thoſe ſhall be the Denominations of the Roote, as in the former Example, whereas Seconds doe ſtand ouer the laſt pricke on the left hand, take halfe of that which is 1', wherefore the firſt Number of your Root muſt be minutes, and ouer the reſt of the Numbers of the Root, ſet Seconds, Thirds, and ſo forth, ſucceſſiuely vntill you haue brought your Root to as ſmall Denomination as you deſire.

FINIS.

A BRIEFE DESCRIPTION OF THE TABLES OF THREE SPECIALL RIGHT Lines belonging to a Circle, called *Signes*, *Lines Tangent*, and *Lines Secant*.

Not only ſhewing why they were firſt inuented, and defining the proper tearmes thereto belonging.

But alſo ſhewing diuers neceſſarie vſes thereof, written by Maſter BLVNDEVILE.

LONDON,
Printed by WILLIAM STANSBY.

THE DESCRIPTION AND VSE OF THE TABLES OF SINES.

Becauſe there is no proportion, compariſon, or likeneſſe betwixt a right Line, and a crooked, the ancient Philoſophers as Ptolomey and diuers other, were much troubled in ſeeking to know the meaſures of a Circle or any portion thereof by his Diameter, and by knowing the Diameter to find out the length of any Chord in a Circle, which is alwayes leſſer then the Diameter it ſelfe, and finding that the more parts whereunto the Diameter was diuided, the neerer they approched to the truth: Some of them therefore, as Ptolomey, diuided the Diameter of a Circle into 120. parts, and the Semidiameter into 60. parts, and euery ſuch part into 60. and euery minute into 60. ſeconds. &c. And in like manner did Arzahel, an ancient Arabian, who diuided the Diameter into 300. parts, and the Semidiameter into 150. and euery of thoſe parts into 60. and ſo forth as before, according to which computation they made their Tables: but becauſe the working by thoſe Tables was very tedious and troubleſome, by reaſon that it was needfull continually to vſe the Arte of numbring by Aſtronomicall Fractions: therefore Georgius Purbachius, and Regio Montanus his Scholler, to auoyde that trouble of calculating by Aſtronomicall Fractions, diuided the Diameter of a Circle into a farre greater number of parts, and made ſuch Tables as are vſed at this preſent, the deſcription and vſe whereof doth heereafter follow, firſt of thoſe that are ſet downe by Monte Regio in Folio, and then of thoſe that were lately corrected and made perfect by Clauius the Ieſuite which are printed in Quarto.

And becauſe that the way to finde out the proportion which any Chord hath to the whole Diameter, was very hard, therefore the ſaid Purbachius and Monte Regio, hauing direction from certaine propoſitions of Euclid, as for the 47. propoſition of his firſt Booke, and from the third propoſition of his third Booke, and from the 15. propoſition of his fift Booke, they made thoſe of the halfe Chord and Semidiameter of the Circle, calling the halfe Chord, Sinum rectum, and the Semidiameter Sinum totum. And becauſe that the proportion of any Circumference to his Diameter neuer changeth, how great or how little ſoeuer the Circle be: after that they had calculated for one Circle, they made ſuch Tables as might ſerue for all Circles, and though theſe Tables of ſignes doe ſuffice to worke thereby all manner of concluſions, as well of Aſtronomie, as of Geometrie, yet for more eaſe, our moderne Geometricians haue of late inuented two other right lines belonging to a circle; called lines Tangent, & lines Secant, and haue made like Tables for them that were made for ſignes, and both Tables, that is to ſay, as well of the ſignes, as of the Lines Tangent and Secant, haue one ſelfe manner of working thereby, as ſhall painly appeare héreafter when wee come to deſcribe the ſame. But firſt wee will beginne with the Tables of Signes, and plainly define euery terme or vocable of Art, belonging thereunto: The termes are theſe here following: An Arch, a Chord, Sinus rectus, Sinus verſus, Quadrans, Complementum, and ſinus Complementi.

The definitions of the foreſaid termes.

AN Arch, is any part or portion of the Circumference of a Circle, which in this practiſe doth not commonly extend beyond 180. degrées, which is one half of the Circumference of any Circle, how great or ſmall ſoeuer it bee, for euery Circle contayneth 360. degrées.

A Chorde, is a right line drawne from one end of the Arch to the other end thereof, and note that all Chords are alwayes leſſer then the Diameter it ſelfe, for that is the greateſt Chord in any Circle.

Sinus rectus, is the one halfe of a Chord or ſtring of any Arke, which is double to the Arke that is giuen or ſuppoſed, and falleth with right Angles vpon that Semidiameter, which diuideth the double Arke into two equall parts.

Sinus verſus, that is to ſay, turned the contrary way is a right line, and that part of the Semidiameter, which is intercepted betwixt the beginning of the giuen Arke and the right Sine of the ſame Arke, and this is alſo called in Latine Sagitta in Engliſh a Shaft or Arrow, for the Demonſtratiue figure thereof hereafter following, is not vnlike to the ſtring of a bow ready bent, hauing a Shaft in the middeſt thereof.

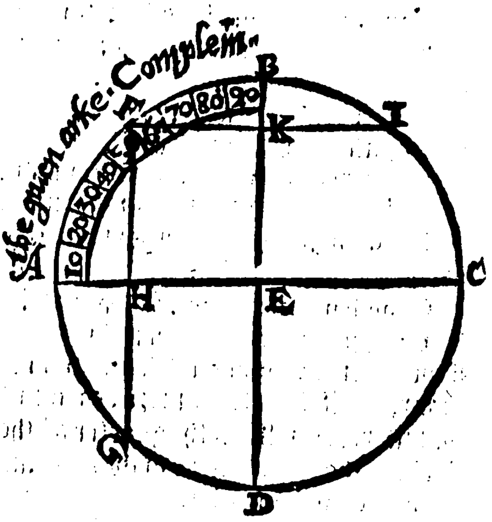
Quadrans, is the fourth part of a Circle contayning 90. degrées.

Complementum arcus, is that portion of the Circle, which ſheweth how much the giuen Arke is leſſer then the quadrant: if the giuen Arke doe contayne fewer degrées then the Quadrant, but if it containe more degrées then the Quadrant, then the difference betwixt the quarter of the Circle, and the ſayd Arch, is the complement of the ſayd giuen Arke.

Sinus complementi, is the right Sine of that Arch which is the complement of the giuen Arke.

Sinus totus, is the Semidiameter of the Circle, and is the greateſt Sine that may be in the Quadrant of a Circle, which according to the firſt tables of Monte Regio containeth 6/000/000. and according to the laſt Tables, 10/000/000. parts, for the more parts that the totall Sine hath, the more true and exact ſhall your worke bée, notwithſtanding, ſometime it ſhall ſuffice to attribute vnto the totall Sine, but 60/000. parts, which numbers Appian obſerueth, in teaching the way to find out the diſtance of two places, differing both in Longitude and Latitude by the Tables of Sines, and ſome doe make the totall Sine to containe 100/000. parts, as Wittikindus in his Treatiſe of Dials, & diuers other doe the like. Alſo Clauius himſelfe ſaith, that in the tables ſet down by him in quarto, you may ſometime make the totall ſine to bee but 100|000. ſo as you cut off the two laſt figures on the right hand in euery ſine, but you ſhall better vnderſtand euery thing here aboue mentioned, by the figure demonſtratiue here following.

The Figure Demonſtratiue.



In this figure you ſée firſt a whole Circle drawne vpon the Center E. and marked with the Letters A. B. C. D. which Circle by two croſſe Diameters, marked with the Letters A. C. and B. D. and paſſing both through the Center E. is diuided into foure Quadrants or Quarters, the vpper Quadrant whereof, on the left hand is marked with the Letters A. B. E. in which Quadrant the right perpendicular Line marked with the Letters F. H. betokeneth the right ſine of the giuen Arke A. F. which right ſine is yͤ one halfe of the Chorde or ſtring F. G. & the giuen Arke A. F. is the one halfe of the double Arke or Bow G. A. F. and A. H. is the Shaft called in Latine Sinus verſus: Againe, the Letters F. B. do ſhew the complement, which together with the giuen Arke A. F. doe make the whole Quadrant A. F. B. which is diuided into 9. ſpaces, euery ſpace contayning 10. degrées, whereby you may plainly perceiue, that in this demonſtration, the giuen Arke, A. F. is 50. degrées, & the cõplement F. B. is 40. degrées, both which being added together, doe make vp the whole Quadrant of 90.

degrées

degrées, marked with the letters A. F. B. Now Sinus complementi is the croſſe line, marked with the letters F. K. the totall Sine, which is the whole Semidiameter, and greateſt right Sine, is marked with the letters B. E. But becauſe it is not enough to know the ſignification of the things aboue ſpecified, to vſe the foreſaid Tables when néed is, vnleſſe you know alſo how to find out thoſe things in the ſaid Tables, I thinke it good therfore to ſhew you the order of the ſaid Tables, by deſcribing the ſame as followeth.

You haue then to vnderſtand, that the Table of Monte Regio, printed in Folio, are contained in 18. Pages, and euery Page containeth 11. Partitions, called Columnes, whereof the firſt on the left hand containeth 60. which are to be counted from head to foot, as they ſtand in order one right vnder another in ſeuerall places, procéeding from 1. to 60. The ſecond Columne containeth Sines. The third containeth only a portion or part of one ſecond, & from thenceforth procéeding towards the right hand, al the other Columnes do containe in like manner Sines, and the portion of one ſecond. And right ouer the head of euery Sine (the firſt Columne of Sines only excepted, hauing nothing but a Cypher ouer his head) are ſet downe the degrées of the whole Quadrant, called Arches, in ſuch order as from the firſt Page to the laſt, there are in all 89. Degrées or Arches, as by peruſing the ſaid Tables, you may plainly ſée. Now to find out in theſe Tables the things aboue mentioned, you muſt doe as followeth.

Firſt, to find out the right Sine of any giuen Arke, you muſt ſéeke out the number of the ſaid Arke in the front of the Tables, and if the giuen Arke hath no minutes ioyned thereunto, then the firſt number of Sines right vnder the ſaid Arke, is the right Sine thereof. But if it hath any minutes ioyned thereunto, then you muſt ſéeke it out in that Page, where you found the giuen Arke, the number of the minutes in the firſt Columne of the ſaid Page, on the left hand, and right againſt thoſe minutes on the right hand, in the ſquare angle right vnder the ſaid Arch, you ſhall find the right Sine. As for example, you would find out the right Sine of a giuen Arke, containing 8. degrées

and

and 2′0. here hauing found out in the front of the ſecond page the figure of 8. ſtanding right ouer the eight Columne, ſeeke in the firſt Columne on the left hand of the ſaid Page, for 2′0. and right againſt the 2′0. you ſhall find on the right hand, in the common Angle or Square, 869,593. which is the right Sine of the foreſaid giuen Arke, ſo as you make 6/000/00. to be the totall Sine: but if you make 60/000. the total Sine, then you muſt alwayes reiect the two laſt figures, ſtanding on the right hand of the ſaid right Sine, and the reſt of the figures ſhall be the right Sine.

Now to find out the complement, there is nothing ſo be done, but only to ſubtract the giuen Arch out of the whole Quadrant, which is 90. degrees, & the remainder ſhall be the complement: as in the former example, by ſubtracting 8 degrees 2′0. out of 90. degrees, you ſhall find that there remaineth 81. degrees, 4′0. which is the complement of that Arch. Againe, to find out the Sine of the complement, you muſt doe thus, ſeeke the complement in the front of the Table of Sines, euen as you do to find out any giuen Arch: as in the former example, the complement being 81. degrees, 4′0. you muſt ſeeke 81. in the front of the 17. Page of the firſt Tables, which being found, ſeeke out alſo the 4′0. in the firſt Columne of the ſaid Page on the left hand, and right againſt thoſe 4′0. in the common Angle right vnder the Arch 81. you ſhall find 5/936/649. which number is the right Sine of the foreſaid complement, ſo as you make 6/000/000. to be the totall Sine, for if 60/000. be the totall Sine, then you muſt reiect (as I ſaid before) the two laſt figures on the right hand, and the number remaining ſhall be the right Sine of the foreſaid complement, and therefore in working by theſe Tables, you muſt alwayes remember what number you make the totall Sine to be.

Sinus verſus commeth ſeldome in vſe, notwithſtanding if you would know how to find it out, you need to doe no more but to ſubtract Sinum complementi of the giuen Arch, out of the totall Sine, and the remainder ſhall be Sinus verſus, as in the former example, your Sinus complementi was 5|936|649. which being ſubtracted out of the totall Sine 6|000|000. there remaineth

remayneth 63|351. and that Number is Sinus verſus: for if you adde this remaender to the Number which you ſubtracted, it will make vp the totall Sine 6|000|000. But there is one thing more neceſſary to bee knowne then this, becauſe it commeth oftner in vſe, and that is vpon ſome diuiſion made how to finde out the Arch of any quotient, which is to be done thus: Enter with the quotient into the bodie of the Tables and leaue not ſeeking amongſt the ſquares of the Sines, vntill you haue found out the iuſt Number of the quotient (if it bee there) if not, you muſt take the Number of that Sine which is in value moſt nigh vnto it, whether it be a little more or leſſe, it maketh no matter, and hauing found that number, looke in the front of that Columne, and you ſhall find the arch of your quotient ſtanding right ouer the head of that Columne, and alſo the minutes thereof in the firſt Columne of the ſaid Page, on the left hand. As for example, hauing diuided one number by another, I find the quotient to be 469|012. whereof I would know the arch: now in ſeeking this quotient among the Sines, I cannot find that iuſt number, but I find in the firſt Page, & in the tenth Columne 469|015. which is the nigheſt number vnto it, that I can ſee. In the front of which Columne, I find the arch to be 4. degrees, and directly againſt that Sine on the left hand, I find 2′9. belonging to that arch, whereof the quotient is the Sinus, ſo as I gather hereof, that the arch of the foreſaid quotient is 4. degrees, 2′9. But you haue to note by the way, that the number of your quotient muſt neuer be much leſſe then 1745. for otherwiſe it is not to be found in theſe Tables, vnleſſe you make the totall Sine to be but 60|000. for then by reiecting the laſt two figures on the right hand, as I haue ſaid before, the firſt right Sine of theſe Tables ſhall be no more but 17. and by that account a very ſmall quotient may be found in theſe Tables: and whatſoeuer hath been ſaid here touching the order that is to be obſerued in the firſt Tables of Monte Regio, whoſe total Sine is 6|000|000. the like in all points is to be obſerued in the laſt Tables, whoſe totall Sine is 10|000|000. Thus much touching the order of ẏ foreſaid Tables of Monte Regio, printed in Folio. But foraſmuch as thoſe Tables be not altogether truly printed, and for that they haue bin lately corrected, and made more perfect by Clauius, who doth ſet downe the ſaid Tables in Quarto, and not in Folio, whereby they are the more portable, and the more commodious as wel for that they are more truly printed, as alſo for that the complement of euery Arch is ſet downe in euery Page at the foot of euery Collum, ſo as you need to ſpend no time in ſubtracting the Arch from 90. I thinke it good therefore to make a briefe deſcription of thoſe Tables, and the rather for that I haue requeſted the Printer to print the like here in Quarto, and I doe worke all ſuch concluſions as hereafter follow, by the ſaid Tables, the total Sine whereof is 10|000|000. according to the laſt Tables of Monte Regio. But for ſo much as ſome may haue already the Tables of Monte Regio, printed in Folio, not knowing perhaps the vſe thereof, I will ſet downe two concluſions to be wrought by thoſe Tables, and all the reſt of the concluſions are to be wrought by thoſe Tables which I haue here cauſed to be printed in Quarto, like to theſe of Clauius: though the two concluſions next following, which are to ſhew the vſe of the foreſaid Tables, may be wrought by the Tables of Sines, in what forme ſoeuer they be truly printed, in Folio or in Quarto, yet becauſe I had appointed them to be done by the Tables of Monte Regio, printed in Folio, before that euer I ſaw Clauius his booke, I mind not now to alter them, but to let them ſtand ſtill as they are.

How to find out by the ſaid Tables, the diſtance betwixt two places, differing both in Longitude and Latitude, making the totall Sine to be no more but 60|000.

THis is done by finding out two numbers, whereof the one is called in Latine Primum inuentum, that is to ſay, the firſt found number; & the other is called, Secundum inuentum, that is, the ſecond found number, in ſuch order as followeth.

Firſt then, knowing the Longitude of eyther place, take the difference of their Longitudes, by ſubtracting the leſſer Longitude out of the greater: that done, multiply the right Sine of that difference into the Sine of the complement of the leſſer Latitude, and diuide the product of that Multiplication by the totall Sine, and then ſeeke out the arch of that quotient, according to the rule before taught, ſo ſhall you haue the firſt found number: That done, multiply the right Sine of the leſſer Latitude by the totall Sine, and hauing diuided the product thereof by the right Sine of the complement of the firſt found number, ſubtract the arch of that quotient out of the greater Latitude, and you ſhall haue the ſecond found number: Then multiply the right Sine of the complement of the firſt found number into the right Sine of the complement of the ſecond found number, and hauing diuided the product of that multiplication by the totall Sine, ſeeke the Arke of the quotient in the Tables, and take that Arke out of the whole quadrant, and the degrees that doe remaine, are degrees of the great Circle, which if you multiply by 60. the product of the multiplication will ſhew you how many Italian miles the one place is diſtant from the other, or if you would haue Germane miles, then multiply the foreſaid degrees of the great Circle by 15. or elſe diuide the product of the Italian miles by 4. and you ſhall haue your deſire. As for example, you would know what diſtance is betwixt Hieruſalem and Noremberg, a famous Towne in Germany: Hieruſalem according to Appian his Tables, hath in longitude 66. degrees, 0′. and in latitude 31. degrees, 4′0. Againe, Noremberg hath in longitude 28. degrees, 2′0. & in latitude 49. degrees, 2′4. the difference of their longitudes is 37. degrees, 4′0. the right Sine whereof is 36/664. for in this example Appian maketh 60|000. to be the totall Sine, and therefore he reiecteth the two laſt figures on the right hand, found in the firſt Tables of Monte Regio. Now you muſt multiply 36/664. into the right Sine of the complement of the leſſer latitude, which Sine is 51/067. the product of which two Sines being multiplyed the one by the other, amounteth to 1/872/320/488. which if you diuide by the totall Sine 60|000. you ſhall find in the quotient 31|205. whoſe arch is 31. degrees, 2′0. and this ſhall be your firſt found number. This done, multiply the right Sine of the leſſer Latitude, which is 31/498. by the totall Sine 60|000. and the product thereof will be 1|889|880|000| which ſumme if you diuide by the Sine of the complement of the firſt found number, which Sine is 51/249. you ſhall find in the quotient 36876. the Arke whereof is 37. degrées, 5'5. which Arch being ſubtracted out of the greater Latitude, there will remaine 11. degrées, 2'9. and that ſhall be your ſecond found number, then multiply the foreſaid Sine of the complement of the firſt found number, which is 51/249. by the Sine of the complement of the ſecond found number, which is 58/798. and the product thereof will amount to 3|013|338.702. which if you diuide by the totall Sine, you ſhall find in the quotient 50|222. the arch whereof is 56. degrées, 5'0. which being ſubtracted out of the whole Quadrant, which is 90. degrées, there will remaine 33. degrées, 1'0. of the greater Circle, which 33. degrées if you multiply by 60. it will make 1980. miles, whereunto you muſt adde for the 1'0. 10. miles, ſo ſhall you find the diſtance betwixt the two foreſaid places, to be 1990. Italian miles, which if you would reduce into Germane miles, then diuide that number by 4. for foure Italian miles doe make but one Germane mile, ſo ſhall you haue 497. Germane miles, and two Italian miles remaining, which is halfe a Germane mile: Which ſumme agréeth with that which Appian ſetteth downe in his Geographie, whereas he vſeth the ſelfe-ſame example, and worketh it in like manner, Per Tabulas Sinuum.

The Altitude of the Sunne being knowne, how to find out the Longitude of the ſhadow both right and verſe of any body yeelding ſhadow, by helpe of the foreſaid Tables.

FIrſt you haue to vnderſtand, that euery bodily thing yéelding ſhadow, is diuided into 12. equall parts, and euery ſuch part into 60. minutes, and euery minute into 60. ſeconds, and ſo forth. Againe, of ſhadowes there be two kinds, that is, Vmbra recta, and Vmbra verſa: Vmbra recta, is that which procéedeth from ſome body rightly erected vpon the vpper face of the Horizon, as from ſome Tower or poſt ſtanding right vp vpon a leuell ground, and that ſhadow is called Vmbra verſa, which procéedeth from ſome right ſtile or pearch, being thruſt into a wall or poſt, ſtanding right vp, and not leaning, in ſuch ſort, as the ſaid ſtile or pearch may be a iuſt parallell to the vpper face of the Horizon. Now to find out the length of either of the foreſaid ſhadowes, you muſt doe thus.

Multiply the right Sine of the complement of the giuen Solar altitude, by 12. and diuide the product by the right Sine of the ſaid Solar altitude, and you ſhall haue the Longitude of the right ſhadow of the ſaid body. Againe, if you multiply the right Sine of the foreſaid altitude by 12. and diuide the product by the Sine of the complement of the ſaid altitude, you ſhall haue the Longitude of Vmbra verſa of the ſaid body. As for example, ſuppoſe the giuen Solar altitude to be 25. degrées, the complement whereof is 65. and the right Sine of that complement is 54/378. if you make the totall Sine to be 60|000. Then in multiplying the foreſaid right Sine by 12. the product will be 652|536. which if you diuide by the Sine of the altitude, which is 25|357. you ſhall find the longitude of Vmbra recta to be 25. parts, 4'4. 4''. and 6'''. Now if you multiply the Sine of the altitude, which is 25|357. by 12, and diuide the product by the Sine of the complement, which is 54|378. you ſhall find the Longitude of Vmbra verſa to be 5. parts 3'5. and in ſaying here part, I meane alwayes ſuch parts, as are the twelue parts, whereunto the body yéelding ſhadow, is diuided: But if you worke this example by the firſt Tables of Sines, making the totall Sine 6|000|000. though you find it true in the parts and minutes, yet ſhall you not find it ſo in the ſeconds and thirds, and if you worke the ſame by the ſecond Tables, making the totall Sine 10|000|000. you ſhall find it to agrée onely in the parts, but neither in minutes nor ſeconds, which maketh me to ſuſpect, that the Printer hath committed ſome error therein, for both the Tables were made by one ſelfe Rule.

A briefe deſcription of the Tables of Sines printed in Quarto, like vnto theſe which Clauius *ſetteth downe in his Commentaries vpon* Theodoſius *his Spheriques.*

HAuing here before plainly deſcribed vnto you the Tables of Sines made by Monte Regio, which are printed in Folio, and how to vſe the ſame: I will now briefely deſcribe the ſaid Tables lately corrected by Clauius, and were printed in Quarto at Rome, Anno 1586. the totall Sine of which Tables, according to the laſt Table of Monte Regio, is 10|000|000. by which Tables are to be wrought all the Concluſions hereafter following.

Firſt then you haue to vnderſtand, that theſe Tables are contained in 36. pages, in the front whereof are ſet down the degrées of the quadrant, procéeding from 1. to 89. but becauſe the whole number of minutes belonging to the ſaid degrée, which is 6'0. cannot be all placed in one ſelfe page, but onely 3'0. in the left outermoſt Columne of the left hand page: & other 3'0. in the left outermoſt Columne of the right hand page: therfore the degrées or arches of the quadrant are faine to be twice repeated in the front of euery two pages, as you may plainly ſée by viewing the ſaid Tables, & euery page containeth ſeuen Columnes, whereof the firſt on the left hand containeth the minutes belonging to the degrées or arches of the quadrant, which minutes do procéed downward from 1. to 3'0. and the ſeuenth Columne on the right hand in euery page, containeth the minutes belonging to the complemēt of euery arch, which minutes do procéed backward, that is to ſay, from 1. ſet downe at the loweſt end of the laſt Columne of the ſecond page, & ſo procéeding vpward to 3'0. which 3'0. is alſo ſet down at the loweſt end of the laſt Columne of the left hand page, & ſo procéedeth vpward to 6'0. which 6'0. do helpe to make vp the complement that is anſwerable to euery arch wherunto no minutes be annexed, for if yͤ arch hath no minutes, then you muſt adde to the complement thereof 6'0. which is one whole degrée, to make vp the complement. As for example, ſuppoſe the Ark to be 46. degrées, without any minutes ioined therunto the complement whereof ſet downe at the foote of the ſayd Arch, is but 43. degrées, wherefore you muſt adde thereunto 6'0 which is one degrée, ſo ſhall the complement bee 44. Degrées, which is the true complement indéed, but if you ſuppoſe the foreſayd Arke to haue 1'3. ioyned thereunto, you ſhall finde the complement to be 43. degrées 4'7. which is anſwerable to the foreſaid Arch, 46. degrées and 1'3. for if you take 46. degrées, 1'3. out of 90. degrées, the remaynder will be 43. degrées, 4'7. which is the complement, ſo as you néede not to make any Subtraction out of 90. to finde the complement of any arch, that hath any minutes annexed therunto: but whenſoeuer you haue to find out the right Sine of any complement in theſe Tables, you muſt then make the complement an arch, ſéeking for the ſame in the Front and not at the foot of the Tables, and if the ſaid complement haue any minutes annexed thereunto: you muſt ſéeke thoſe minutes in the left outermoſt collum of euery page, and not in the outermoſt right collum belonging to complements, for in this caſe the complement is an arch and not a complement. The order of working by theſe Tables in all other things differeth not one iot from that which we haue obſerued in working the two former concluſions by the Tables of Monte Regio printed in Folio, as you ſhall eaſily perceiue by the Examples here following.

1 *How to find out the declination of the Sunne at any time his place in the Zodiaque being giuen,* Per Tabulas Sinuum.

KNowing the place of the Sunne for the day, conſider how much the ſaid place is diſtant from the firſt point of Aries, if the place of the Sunne be nigher to Aries then to Libra. But if it be nigher to Libra, then take his diſtance from the firſt point of Libra, which diſtance muſt not excéed 90. degrées, and ſéeke that diſtance amongſt the Arches in the Front of the Tables if they be degrées, if minutes, you ſhall find them in the firſt collum on the left hand, then multiply the Sine of that diſtance by the Sine of the greateſt declination which is 23. degrées 2'8. & diuide the product thereof by the totall Sine, and the quotient will ſhew you the ſine of the declination for that day, the arch whereof is the very Number of the declination it ſelfe. As for Example, you would know the declination of the Sunne the eleuenth of April 1591. when as the Sunne was entred 3'3. into Taurus, vnto which you muſt adde according to the Rule before giuen 30. degrees, for that is his diſtance from the firſt point of Aries, then ſeeke out the ſaid 30. degrees, in the front of the laſt Tables among the Arches, and the 3'3. in the firſt Collum on the left hand, right againſt which you ſhall finde the ſine of the ſayd diſtance to bee 5082/901. which being multiplyed by 3/982/155. (which is the ſine of the greateſt declination) the product thereof will bee 20/240890/631/655. which if you diuide by the totall Sine which is 10/000|000. you ſhall find the quotient to bee 2|024|089. which quotient muſt be ſought out in the ſaid Tables, and if you find no ſuch Number, then take the neereſt Number thereunto, which is 2025025. and the Arch thereof together with the minutes that ſtand right againſt the ſaid quotient in the firſt Collum on the left hand, is the declination of the Sunne for that day, which is 11. degrees, 4'1.

2 *How to know the right aſcenſion of the Sunne*
Per Tabulas Sinuum.

First, knowing the Suns place, you ſhall learne the right aſcenſion thereof thus. Firſt, conſider how farre his place is from the Equinoctiall point, as is ſayd before in the laſt propoſition, and multiply the ſine of the complement of that diſtance by the totall ſine, then knowing the declination of the Sunne for that day, by the laſt Rule, diuide the former product by the ſine of the complement of the ſaid declination, and the quotient will ſhew the ſine of that Arch, whereof the complement is the right aſcenſion. As for Example, the Sunne being in the 3'3. of Taurus, and his declination 11. degrees, 4'1. as you found by the laſt propoſition, and his diſtance from the firſt point of Aries, to be in all 30. degrees, 3'3. the complement whereof is 59. degrees, 2'7. the ſine of which complement is, 8|611|860. which being multiplyed by the totall ſine, which

is 10|000|000. the product will be 86|118|600|000|000. which being diuided by the Sine of the complement of the Sunnes declination, which is 78. degrees 1'9. whoſe Sine is 9792818. by which Sine if you diuide the former product, the quotient will be 8|794|057. the Arch of the quotient is 61. degrees and 3'4. and the complement of that is 28. degrees, and 2'6. which is the right aſcenſion of the place of the Sunne for the foreſayd day.

And heere note, that if the Arch from Aries to the giuen point, doe contayne iuſt 90. degrees, the right aſcenſion thereof is alſo 90. degrees, but if the ſayd Arch be more then 90. degrees, and leſſer then 180. degrees, then ſubtract the ſame out of 180. and ſeeke out the right aſcenſion of the remaynder as before, whoſe right aſcenſion if you take out of 180. the remaynder ſhall be the aſcenſion of the propounded arch. But if the ſayd arch which is comprehended betwixt Aries and the giuen point, be greater then 180. degrees, or 6. ſines, and leſſer then 270. degrees, or 9. ſines, then hauing ſubtracted 180. degrees from the ſame arch, calculate the right aſcenſion of the arch from the beginning of Libra, as before, and the right aſcenſion thereof being added to 180. degrees ſhall be the aſcenſion deſired.

Laſtly, if the arch comprehended betwixt Aries and the point giuen, be greater then 270. degrees, or 9. ſines, then ſubtract the ſame out of 360. degrees, and ſeeke out the right aſcenſion of that remaynder as before, which if you ſubtract out of 360. degrees, the remaynder ſhall be the right aſcenſion deſired.

3. *How to find out the aſcenſionall difference*
Per Tabulas Sinuum.

Multiply the ſine of the latitude giuen by the totall ſine, and diuide the product by the complement of the ſaid latitude, that done, multiply the quotient by the ſine of the Suns declination, & diuide the product by the ſine of the complement of the declination, and the quotient thereof will ſhew the ſine of the aſcenſionall difference: and by working according to this

Rule, you ſhall find that when the Sun is entred 3'3. into Taurus, at which time his declination is 11. degrées, 4'1. (as haue béene ſaid before) the aſcenſionall difference will be 15. degrées, 2'1. And here note that the aſcenſiall differences for one quarter of the Circle ſerueth alſo for all the reſt, ſo that the Latitude be not altered, and that the declination of the points in the latter quarters, be equall to the declination of the points in the firſt quarter.

4 *How to find out the oblique aſcenſion of any point of the Ecliptique in any Latitude aſſigned.*

FIrſt finde the right aſcenſion of the giuen point by the ſecond propoſition, and alſo the aſcentionall difference thereof by the third Propoſition: then conſider whether the declination of the ſayd point be Northward or Southward, for if it be Northward, then ſubtract the aſcentionall difference out of the right aſcenſion, and the remaynder ſhall be the oblique aſcenſion deſired: but if the Declination be Southward, then adde the aſcenſionall difference vnto the right aſcenſion, and the ſumme ſhall bee the oblike aſcenſion. In working thus for the Latitude 52. and ſuppoſe the Sun to be in the 3'3. of Taurus and hauing found by the former Propoſition his right aſcenſion to be 28. degrées, 4'1. and the aſcenſionall difference to be 15. degrées, 2'1. you ſhall find his oblike aſcenſion in the foreſayd Latitude to be 13. degrées, 2'0.

5 *How to find out the time of the Sunnes riſing and ſetting, and thereby the length of the artificiall Day.*

FIrſt, you muſt know the aſcenſionall difference, & conuert the ſame into houres & minutes, then if the Sun bee in any of the Northerne ſignes, adde thoſe houres to 6. houres, which is the one halfe of an Equinoctiall Day, and the ſumme of ſuch Addition ſhal be the one halfe of the artificiall day, which being ſubtracted out of 12. houres, the remaynder ſhall be the houre of the Sunnes riſing: As for Example, the Sun being in the 3'3.

of

of Taurus, you found the aſcentional difference to be 15. degrées and 2'1. which being turned into houres maketh one houre 1'. ",. and ſomewhat more, which being added to 6. maketh 7. houres 1'. ",. and a little more, which is the one halfe of the artificiall day, which being doubled, maketh in all 14. houres 2'. and ",. but if the Sunne be in any of the Southerne ſignes, you muſt remember to ſubtract the houres of the aſcentionall difference out of 6. houres, and the remaynder ſhall be the one halfe of the artificiall day, and by ſubtracting the halfe length of the artificiall day out of 12. you ſhall know the houre of the Sunnes riſing, & hauing the time of his riſing, you muſt néeds know the time of his ſetting.

6 *How to find out the Mrridian Altitude of the Sunne in any day, though he doth not ſhine at all, the eleuation of the Pole being giuen.*

SUbtract the eleuation of the Pole from 90. and the remainder ſhall be yͤ eleuation of the Equinoctiall; then if the Sun be in any of the Northerne ſignes, adde the declination of the Sunne vnto the altitude of the Equinoctiall, or elſe if hee bée in any of the Southerne ſignes, ſubtract the declination, and the Summe of the Addition, or remaynder of the Subtraction, ſhall ſhew the Meridian Altitude. As for Example, the ſecond of May 1591. the Sunne being in the 20. degrées, 4'2. of Taurus, and his declination Northward 17. degrées, 5'6. ",. here by ſubtracting 52. degrées, which is our Latitude from 90. you ſhall find the remaynder to bee 38. which is the Altitude of the Equinoctiall, whereunto if you adde the Suns declination for that day which is 17. degrées, 5'6. and ",. the Summe will bée 55. degrées, 5'6. and ",. and that is the Meridian Altitude of the Sunne for that day.

Let theſe few concluſions ſerue to ſhew you the vſe of the Tables of Sines, for it would make a long Booke to ſet downe ſo many concluſions as are to bee wrought by theſe Tables, & therefore I leaue to trouble you any further therewith, minding now briefly to declare vnto you the vſe of the Tables

of

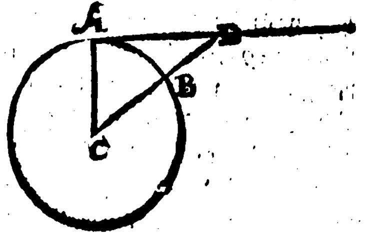
of lines Tangent and Secant by one Example or two as followeth. But firſt I thinke it neceſſary to ſhew you what theſe lines be, and whereto they ſerue.

The Deſcription and vſe of the Tables of Tangents and Secants.

EVclid in the ſecond Propoſition of his third Booke defineth the line Tangent in this ſort. A right line (ſaith he) is ſaid to touch a Circle, when it toucheth it ſo, as being drawne out in length, it would neuer cut the ſayd Circle.

The Line Secant is not by him any where defined, but what theſe two lines are, you ſhal better vnderſtand by this figure Demonſtratiue héere following, then by any definition that can be made thereof: for a definition ought to bee plaine and briefe and not long, intricate or doubtful, which wil be hardly performed in ſhewing the nature of theſe two lines by way of definition, and therefore marke well this figure following.

In this figure you ſée firſt a Circle drawne vpon the Center C. from which Center is extended to the Circumference of the Circle, a right line called the Semidiameter, marked with the Letters A.C. then there is another right line which toucheth the ſaid circle, and alſo the outermoſt end of the ſaid Semidiameter, making therewith a right Angle in the point A. and is called the line Tangent, then there is a third line which proceeding from the Center C. doth cut the Circumference of the Circle in the point B. and alſo méeteth with the Line Tangent in the point D. and therefore is called the Line Secant, be-



twixt which two Lines I meane the Tangent and Secant, is intercepted or included a certaine portion or Arch of the foreſaid Circle, leſſe then a Quadrant marked with the Letters A. B. of which Arch the Line A.D. is the Tangent, and the line C. D. is the Secant thereof, which muſt néeds méet with the Tangent in the point D. becauſe that the two Angles C. A. D. and D.C.A. are leſſer then the two right Angles, for the one is right, and the other ſharpe, by reaſon that the Arke is leſſe then a Quadrant. And ſome do call the Line Tangent, the Line Aſcript, becauſe it is aſcribed to the Circle, & they call the Line Secant the Hipothenuſe, becauſe it ſubtendeth the right Angle A. and they call the Semidiameter or totall Sine, the Baſe of the Rectangle Triangle C. A. D. which is called a Rectangle Triangle, becauſe it contayneth one right Angle marked with the Letter A. and note that whenſoeuer any manner of Angle is propounded by thrée Letters, that the middle Letter doth alwayes ſignifie the Angle propounded, bée it right, ſharpe, or blunt. Now, if you would know to what end the foreſaid two Lines were inuented, and whereto they ſerue, you haue to vnderſtand, that they chiefly ſerue in calculating the quantitie of Angles and their ſides, as well in right lined Triangles as in Sphericall Triangles, for the ſides of Triangles are eyther right or crooked, and if they haue right ſides, ſuch Triangles are eyther right angled Triangles, or oblique angled Triangles. And you haue to note that the quantitie of euery angle is to be meaſured by the arch of a circle ſubtending that angle, for the point of euery angle is imagined to be the center of a whole circle, which you may ſuppoſe to be ſo great or little as you will, for euery Circle (bée it great or little) is diuided into 360. degrées, and looke how many degrées and minutes the Arch ſubtending that Angle contayneth, ſo much is the quantity of that Angle, the practiſe whereof is very well ſet downe by Clauius in his Commentaries vpon Theodoſius, which I minde (God willing) hereafter to tranſlate in our mother tongue: In the meane time my intention héere, is onely to ſhew you by one Example or two, the vſe of the Tables made for the foreſaid Line Tangent and Secant.

The vſe of the ſayd Tables according to Clauius, *is thus.*

IN ſéeking out the Tangent or Secant of any Arke giuen, or of the complement of any Arke by eyther of theſe Tables, you haue to obſerue the ſelfe-ſame order which you did before in finding out the right ſine of any Arke giuen, or of the complement of any Arke, Per tabulas ſinuum. As for Example, if you would find out the Tangent of an Arke, contayning 50. degrées 2'4. then reſort to the Table of Tangents; in the front whereof, looke firſt for the Aarke 50. degrées, and then in the firſt Collum on the left hand of the ſaid Table, for 2'4. right againſt which on the right hand vnder the Arke 50. you ſhall find in the common Angle the Tangent to be 12|087|923. the totall ſine whereof is 10/000/000. but if you would finde out the Secant of the foreſaid Arke 50. and 2'4. then you muſt reſort to the Table of Secants, and hauing found out the Arke 50. in the Front of the ſaid Tables, and the 2'4. on the left hand as before, you ſhall finde in the common Angle the Secant to be 15688144. And if you would haue the Tangent of the complement of the ſaid Arke, which is 39. degrées, and 3'6. you ſhall finde the 39. degrées, of the complement in the foote of the Table of Tangents right vnder the Arke 50. and the 3'6. in the outermoſt Collum on the right hand of the ſaid Table, with which complement you muſt enter the Table of Tangents, ſéeking for 39. degrées in the front of the Table, and 3'6. in the 1. collum on the left hand of the ſaid Table, right againſt which in the common Angle, you ſhal finde 8272720. to the Tangent of 39. degrées 3'6. which is the complement of 50. degrées, 2'4.

And you muſt worke in like manner with the Table of Secants: As for Example, if you would find the Secant of 72. degrées, 3'6. firſt then enter yͤ Table of Secants looking for 72. degrées, aboue in the front of the Table, and 36. in the firſt collum, on the left hand of the ſaid Table, and in the common Angle you ſhall finde 33/440/249. which is the Secant of 72. degrées 3'6. But if you would haue the Secant of the complement of the ſaid Arch, 72. degrées 3'6. then looking in the foote

of the Table right vnder 72. degrées, you ſhall find 17. degrées, and in the outermoſt Columne on the right hand, iuſt againſt 3'6. you ſhall find 2'4. ſo as you ſée that 17. degrées 2'4. is the complement of 72. degrées 3'6. with which complement you muſt enter the Table of Secants, looking for 17. degrées, aboue in the front of the Table, and for 2'4. in the firſt Columne on the left hand of the ſaid Tables, and in the common Angle you ſhall find 10/479/542. to be the Secant of the Arch, 17. degrées 2'4. which is the complement of the Arch, 72. degrées 3'6.

The vſe of which Tables in Aſtronomicall matters, I haue here ſet downe, as followeth.

1 *To find out the declination of the Sunne, the place thereof being knowne.*

MUltiply the Secant of the complement of the greateſt declination by the totall Sine, and diuide the product by the Sine of the Sunnes diſtance from one of the Equinoctiall points, the quotient is the Secant of an Arch, whoſe complement is the declination of the Sunne: For example, ſuppoſe that the Sunne be entring into ♉, to find the declination thereof, firſt I multiply 25112030. the Secant of 66. degrées 3'2. (which is the complement of 23. degrées 2'8. the greateſt declinatiõ) by 10000000. yͤ product is 251120300000000. which being diuided by 5000000. (the Sine of 30. degrées the Sunnes diſtance from the Equinoctiall point) the quotient is 50224060. for which number I ſéeke in the Table of Secants, the Arch anſwering néereſt vnto it, is 78. degrées 3'1. the complement whereof is 11. degrées 2'9. which is the declination of the Sunne.

2 Knowing the declination of the Sunne, how to find his diſtance from the Equinoctiall point, and ſo conſequently his place in the Zodiaque.

MUltiply the Secant of the complement of the greateſt declination by the totall Sine, and diuide the product by the Secant of the complemēt of the declination giuen, the quotient is the diſtance of the Sunne from the Equinoctial point. As for example, the declination of the Sunne is ſuppoſed to be 11. degrées, 2'9. then to find his diſtance from the Equinoctial, I multiply 25112030. the Secant of 66. degrées, 3'2. which is the complement of the greateſt declination (by the totall Sine the product is 251120300000000) which I diuide by 50224350. the Secant of 78. degrées, 3'1. the complement of 11. degrées, 2'9. the ſuppoſed declination, the quotient is 5000000. the Sine whereof is 30. degrées, 0'. which is the diſtance of the Sunne from the Equinoctiall; then for his place, you muſt take the ſame according to the ſeaſon of the yere, for if it be in April, then the Sunne is entring into Taurus, but if it be in Auguſt, it is entring into Virgo, and being in October, it is entring into Scorpio, and being in February, it is in the beginning of Piſces.

3. To find out the right aſcenſion of the Sunne.

MUltiply the Tangent of the diſtance of the Sun from the Equinoctial point, which is néereſt vnto it, by the Sine of the complement of the greateſt declination, & diuide the product by the totall Sine, the quotient is the Tangent of the right aſcenſion of the Sun, for which if you ſéeke in the Table of Tangents, the arch anſwering vnto it, is your deſire: For example, the Sun being in the firſt of Taurus, to know the right aſcenſion thereof, I multiply 5773502. the Tangent of 30. degrées (for that 30. degrées is the diſtance of the Sun from the Equinoctial point) by 9172920. the Sine of 66. degrées, 3'2. which is the complement of 23. degrées, 2'8. the greateſt declination, the product is 52959871965840. which being diuided by 10000000. the totall

Sine, the quotient is 5295987. which is the néereſt Tangent of 27. degrées, 5'4. which is the right aſcenſion of the Sun, being entred into Taurus.

4 How to find out the declination of the Sunne, knowing onely the right aſcenſion thereof.

MUltiply the Tangent of the complement of the greateſt declination by the totall Sine, & diuide the product by the Sine of the right aſcenſion giuen, the quotient is the Tangent of the complement of the Sunnes declination: for example, the right aſcenſion of the Sunne being 27. degrées, 5'4. I would know the declination thereof, multiplying 23035062. the Tangent of 66. degrées, 3'2. the complement of 23. degrées, 2'8. by 10000000. the product is 230350620000000. which being diuided by 4679298. the Sine of the giuen aſcenſion, the quotient is 492276. the Arch of which Tangent is 78. degrées, 3'1. which being ſubducted out of 90. the remainder is 11. degrées, 2'9. and ſo much is the declination of the Sunne.

5 How to find the place of the Sunne, knowing onely the right aſcenſion thereof.

SUbduct the right aſcenſion giuen out of 90. if it be leſſe then 90. but if the ſame be more then 90. ſubtract the aſcenſion giuen out of 180. and being greater then 180. ſubduct the ſame out of 270. or being greater then 270. ſubduct the ſame from 360. and multiply the Tangent of the remainder by the Sine of the complement of the greateſt declination, & diuide the product by the totall Sine, the quotient is the Tangent of the complement of the Sunnes diſtance from one of the Equinoctiall points: which diſtance being knowne, the place of the Sunne may eaſily be knowne. For example, ſuppoſing the right aſcenſion of the Sun to be 27. degrées 5'4. the complement thereof is 62. degrées 6'. the Tangent whereof is 18886715. which being multiplyed by 9172920. the Sine of 66. degrées, 3'2. the complement of the greateſt declination, the product is 173245985757800. which being

being diuided by 10000000. the quotient is 17324598. For which I looke in the Table of Tangents, & I find the arch thereof to be 60. the complement whereof is 30. which is the diſtance of the Sun from the Equinoctiall point, that is, from Aries, for that the right aſcenſion is leſſe then 90. I ſay then that the Sun is in the beginning of Taurus. But if the right aſcenſion had bin more then 90. and leſſe then 180. the place of the Sun had bin betwixt Cancer and Libra, 30. degrées from Libra, ſo ſhould it haue bin in the firſt point of Virgo: but if the right aſcenſion had bin more then 180. the place of the Sun ſhould be betwixt Libra and Capricorne, that is, in the beginning of Scorpio, but being more then 270. the place of the Sun ſhould be betwixt Capricorne and Aries, that is, in the beginning of Piſces.

6 *To find out the aſcenſionall difference of the Sunne, or any ſtarre in the Firmament, knowing the declination thereof, and alſo the Latitude of your Region.*

MUltiply the Tangent of the declination of the Sunne or ſtarre by the Tangent of the latitude of the place, and diuide the product by the totall Sine: the Sine of the quotient is the Sine of the aſcenſionall difference, the Arch whereof is the deſired aſcentionall difference. For example, let the declination of the Sun-ſtarre, or other point in the firmament, be 10. degrées 3'. and ſuppoſe the latitude to be 52. degrées, the Tangent of 10. degrées 3'. is 1772268. the Tangent of 52. degrées is 12799416, which being multiplied together, the product will be 2267/4995/395488. which being diuided by 10000000, the totall Sine, the quotient is 2267499. for which number I looke amongſt the Sines, the arch anſwering thereunto, is 13. degrées 6'. which is the aſcenſionall difference deſired.

7 *To find out the oblique aſcenſion of the Sunne.*

KNowing the place of the Sun, find out the right aſcenſion of the ſame by the third propoſition, and find alſo the aſcenſionall difference of the ſame point, then if the declination of

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the Sunne be North, ſubduct the aſcenſionall difference out of the right aſcenſion, the remainder is the oblique aſcenſion. For example, ſuppoſe the Sunne to be in the beginning of Taurus, now to find the oblique aſcenſion thereof in the Latitude of 52. degrées, firſt, by the third propoſition, I find out the right aſcenſion of the beginning of Taurus, which I find to be 27. degrées 54. then by the firſt propoſition I find the aſcenſionall difference to be 13. degrées 6'. which being ſubducted from 27. degrées 5'4. the right aſcenſion (for that the declination is North) the remainder is 14. degrées 4'8. and ſo much is the oblique aſcenſion for the Latitude of 52. degrées. But if the Sunne be in any of the Southerne Signes, and that the declination be South, then the aſcenſionall difference is to be added to the right aſcenſion before giuen.

8 *To find out the oblique deſcenſion of the Sunne at any time.*

FIrſt, find out the right aſcenſion of the Sunne by the third propoſition, the ſame ſhall be the right deſcenſion thereof: then find the aſcenſionall difference by the firſt propoſition, and if the Sunne be in any of the Northerne ſignes, adde the aſcenſionall difference vnto the right aſcenſion, the ſumme ſhall be the oblique deſcenſion of the Sunne: but if it be in any of the Southerne ſignes, ſubduct the aſcenſional difference out of the right aſcenſion, the remainder is the deſired deſcenſion: as for example, the Sunne being in the beginning of Taurus, the right aſcenſion thereof by the third propoſition is 27. degrées, 5'4. the aſcenſionall difference thereof by the firſt propoſition is 13. degrées, 6'. foraſmuch then as Taurus is a Northren ſigne, I adde the aſcenſionall difference vnto the right aſcenſion, the ſumme is 24. degrées, 5'8. and ſo much is the oblique deſcenſion of the Sunne, being in the beginning of Taurus.

9 *To find out the length of the Day or Night.*

HAuing found out the aſcenſionall difference by the firſt propoſition, adde the ſame vnto 90. if the Sunne be in any

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of the Northerne ſignes, but if it be in any of the Southerne ſignes, ſubduct the aſcenſionall difference out of 90, then diuide the ſumme of the addition, or the remainder of the ſubtraction by 15. the quotient wil ſhew the halfe length of the day in houres and minutes, which being doubled, you ſhall haue the whole length of the artificiall day: For example, the Sunne being in the beginning of Taurus, the aſcenſional difference thereof is 13. degrées, 6'. which for that the Sunne is in a Northerne ſigne, I adde vnto 90. degrées, the ſumme is 103. degrées, 6', which being diuided by 15. the quotient is 6. houres, 5'2. the halfe length of the day, which being doubled, will be 13. houres, 4'2. the whole length of the artificiall day, in the Latitude of 52. degrées.

10 *To find the houre of the Sunne his riſing or ſetting in the Latitude aſſigned.*

FInd out the halfe length of the artificiall day by the 9. propoſition, and ſubtract the ſame from 12. houres, the remainder will ſhew the houre of the Sunnes riſing: For example, the Sunne being in the beginning of Taurus, to know the houre of his riſing in the latitude of 52. degrées, by the ninth propoſition the halfe length of the artificiall day I find to be 6. houres, 5'2. which I ſubtract from 12. houres, the remainder is 5. houres, 8'. which ſheweth, that the Sunne riſeth at 5. of the clocke, and 8. minutes in the morning, but the halfe length of the day it ſelfe is the houre of the Sunnes ſetting.

11 *To find out the length of the Planetarie houres, and to find what Planet raigneth at any houre of the day.*

FIrſt find out the length of the artificiall day by the ninth propoſition, and diuide the ſame by 12. the quotient is the length of one Planetary houre: or thus, hauing an houre of the artificiall day giuen, looke what houre the ſame is from the Sunne riſing, and multiply the ſame by 12. diuide the product by the length of the artificiall day, the quotient is the number of the Planetary houre. For example, the Sunne being in 30. minutes of Taurus, and our latitude being 52. degrées, the length of the artificiall day by the ninth propoſition is 14. houres: then doe I diuide 14. by 12. the quotient is $1\frac{1}{7}$. that is, 1. houre 1'0. the length of one Planetary houre. But if an houre of the artificiall day be giuen, as that I would know what Planetary houre it is at nine of the clock, the Sunne being in the firſt of Taurus, in the Latitude of 52. degrées, hauing found that the Sunne riſeth at 5. of the clocke, by the tenth propoſition, I ſée that 4. houres of the artificiall day are gone at 9. of the clocke, I therefore multiply 12. by 4. the product is 48. which I diuide by 14. the length of the artificiall day, the quotient is $3\frac{3}{7}$. which is the Planetary houre at the time ſet down: likewiſe ſhall you find the Planetary houre of the night, finding the length thereof, and then worke with it as was ſhewed before for the day.

Now to know what Planet raigneth at any houre of the day or night, is plainely ſet downe in the 52. Chapter, which is the laſt Chapter of my ſecond Booke of the Sphere.

12 *To find the Arch of the Equinoctiall, comprehended betwixt the Meridian and any Circle of Poſition, according vnto* Campanus *and* Gazula.

MUltiply the Sine of the complement of your latitude by the Tangent of the diſtance of the giuen Circle of Poſition from the Zenith, & diuide the product by the totall Sine, the quotient is the Tangent of the arch of the Equinoctial, which is comprehended betwixt the giuen Circle of poſition, & the Meridian. For example, in the latitude of 52. I would know what part of the Equinoctiall is comprehended betwixt the Meridian and that Circle of poſition, which is 30. degrées from yͤ Zenith: the latitude being 52. degrées, the complement thereof is 38. degrées, the Sine whereof is 6156615. and the Tangent of 30. degrées (for that 30. is the diſtance betwixt the giuen Circle of poſition and the Zenith) is 5773502. which being multiplied by 6156915. the product is 35545229015730. which being diuided by 10000000. the total Sine, the quotient is 3554522. for which

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I ſeeke among the Tangents, and I find the Arke anſwering thereunto, to be 19. degrées, 3'4. the Arch of the Equinoctiall, betwixt the Meridian and the giuen Circle of Poſition.

13 *Knowing the Latitude of your Region, and alſo the eleuation of the Pole aboue any Circle of Poſition, how to find the inclination of the ſaid Circle of Poſition vnto the Meridian, and ſo conſequently the Arch of the Equinoctiall, which is betwixt the ſaid Circle of Poſition and the Meridian.*

Multiply the Secant of the complement of the eleuation of the Pole aboue the Circle of Poſition, by the Sine of your Latitude, and diuide the Product by the totall Sine, the quotient is the Secant of the complement of the inclination of the Circle of Poſition vnto the Meridian, and that is the diſtance betwixt the Circle of Poſition and the Zenith, by helpe whereof you ſhall find the Arch of the Equinoctiall, betwixt the Circle of Poſition, and Meridian, as in the former propoſition. As for example, ſuppoſe the eleuation of the Pole aboue the Circle of Poſition in our Latitude of 52. to be 23. degrées, 1'2. Now to find out the inclination of that Circle of Poſition vnto the Meridian, firſt I multiply 25384445. the Secant of 66. degrées, 4'8. (for that is the complement of 23. degrées, 1'2. the eleuation of the Pole aboue the Circle of Poſition) by 7880108. the Sine of 52. the latitude of our Region, the product is 200032168120060. which being diuided by 10000000. the quotient is 20003216. for which I looke in the Table of Secants, and the Arch thereof néereſt is 60. degrées, 0'. the complement whereof is 30. degrées, 0'. which is the inclination of the Circle of Poſition vnto the Meridian, or the diſtance of the Zenith from the ſaid Circle, then to find the Arch of the Equinoctiall betwixt the ſaid Circle of Poſition and the Meridian, repeat the worke of the former propoſition.

14 *To find out the Eleuation of the Pole, aboue any aſſigned Circle of Poſition in any giuen Latitude.*

Knowing the Inclination of the aſſigned Circle of Poſition vnto the Meridian, Multiply the Secant of the complement thereof by the totall Sine, and diuide the product by the Sine of your Latitude, the quotient is the Secant of the complement of the Eleuation of the Pole aboue the giuen Circle of Poſition: as for Example, ſuppoſe the inclination of a Circle of Poſition to be 30. degrées 0'. Now to find the Eleuation of the Pole aboue the ſame for the Latitude of 52. degrées 0'. Firſt take the complement of 30. degrées 0'. which is 60. degrées 0'. the Secant whereof is 20000000. which being multiplyed by the totall Sine, the product is 200000000000000. which being diuided by 7880108. the Sine of 52. the aſſigned Latitude, the quotient is 25380362. for which I ſéeke in the Table of Secants, and the Arch anſwering thereunto, I finde to bee 66. degrées 4'8. the complement whereof is 23. degrées 1'2. and ſo much is the Eleuation of the Pole aboue the aſſigned Circle of Poſition in your Latitude.

Thus much touching the vſe of the Tables of Sines, Tangents and Secants, now here followeth the thrée Tables, firſt the Table of Sines, ſecondly, the Table of Tangnts, and thirdly the Table of Secants.

FINIS.

HEERE FOLLOWETH THE TABLE OF RIGHT SINES, FOR EVERY Minute of the Quadrant, First calculated by *I. Regio Montanus*,

BVT NOW EXAMINED, AND
IN MANY PLACES CORRECTED
AND AMENDED

BY

CLAVIVS.

The degrees of the Quadrant for the right Sines

The minutes of the degrees of the Quadrant for the right Sines of the arches of the ſame Quadrant.

	0	1	2	3	4	
0	0000	174524	348995	523360	697565	60
1	2909	177433	351902	527165	700467	59
2	5818	180341	354809	529170	703369	58
3	8727	183250	357716	532075	706270	57
4	11636	186158	360623	534980	709172	56
5	14544	189066	363530	537884	712073	55
6	17453	191975	360437	540789	714975	54
7	20362	194883	369344	543694	717876	53
8	23271	197792	372251	549568	720777	52
9	26180	200700	375158	549503	723678	51
10	29088	203608	378064	552407	726579	50
11	31997	206517	330971	555312	726480	49
12	34906	206425	383878	558216	732381	48
13	37815	212333	386785	561120	735282	47
14	40723	215241	389692	564024	738183	46
15	43632	218149	392598	566628	741084	45
16	46541	221057	395505	566832	743985	44
17	49450	223965	398412	572736	736886	43
18	52359	226873	401318	575640	749787	42
19	55268	229781	404225	578544	752688	41
20	58177	232689	407131	581448	765588	40
21	61686	235597	410038	584352	758489	39
22	63995	238505	412944	587256	761389	38
23	66904	241312	415851	590160	764290	37
24	69813	244321	418757	593064	767190	36
25	71721	247229	421663	595967	770090	35
26	75630	250137	424570	598871	772991	34
27	78539	252045	427476	601775	775891	33
28	81448	255953	430382	604678	778791	32
29	84357	258861	433288	607582	781691	31
30	87265	261709	436194	610485	784591	30
	89	88	87	86	85	

The minutes of deg. of the Quadrant for right Sines of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the right Sines

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the right Sines of the arches of the ſame Quadrant.

	0	1	2	3	4	
30	87265	161769	436194	610485	784591	30
31	90174	264677	439100	613289	787491	29
32	93083	267585	442006	616292	790391	28
33	95992	270493	444912	619196	793291	27
34	98901	273401	447818	622099	796191	26
35	101809	276309	450724	625002	799090	25
36	104718	278216	453630	627905	801990	24
37	107627	282124	456536	630808	804889	23
38	110536	285032	459442	633711	807786	22
39	113445	287940	462348	636614	810688	21
40	116353	290847	465254	639517	813587	20
41	119262	293755	468159	642420	816486	19
42	122171	296663	471065	645323	819385	18
43	125079	299570	473970	648226	822284	17
44	127988	302478	476896	651129	825183	16
45	130896	305385	479781	654032	828082	15
46	133805	308293	482687	656934	830981	14
47	136714	311200	485592	658837	833880	13
48	139622	314108	488498	662739	836778	12
49	142531	317015	401463	665642	839677	11
50	145439	319922	494308	668544	842576	10
51	148348	322830	497214	671447	845574	9
52	151257	325737	500119	674349	848372	8
53	154165	328645	503024	677251	851271	7
54	157974	331552	505929	680153	854169	6
55	159982	334459	408834	683055	857067	5
56	162891	337367	511740	685957	859965	4
57	165799	340274	514645	688859	862863	3
58	168708	343181	517550	691761	865761	2
59	171616	346088	520455	694663	868659	1
60	174524	348995	523360	697565	871557	0
	89	88	87	86	85	

The minutes of deg. of the Quadrant for right Sines of the cõplements of the arches of the ſame Quadrant.

of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	5	6	7	8	9	
0	871557	1045285	1218693	1397331	1564345	60
1	874455	1048178	1221580	1394612	1567218	59
2	877353	1051071	1224467	1397492	1570091	58
3	880250	1053964	1227354	1400373	1572964	57
4	883148	1056857	1230241	1403253	1575887	56
5	886045	1059749	1233128	1406133	1578709	55
6	888943	1062642	1236015	1409013	1581581	54
7	891840	1065534	1238901	1411893	1584453	53
8	894737	1068426	1241788	1414772	1587325	52
9	897634	1071318	1244674	1417651	1590107	51
10	900531	1074210	1247560	1420531	1593069	50
11	903428	1077102	1250446	1423410	1595941	49
12	906325	1079994	1253332	1426289	1598812	48
13	909222	1082886	1256218	1429168	1601684	47
14	912119	1085778	1259104	1432047	1604555	46
15	915016	1088669	1261990	1434926	1607426	45
16	917918	1091561	1264876	1437805	1610297	44
17	920809	1094452	1267761	1440684	1613168	43
18	923706	1097344	1270647	1443562	1616038	42
19	926602	1100235	1273532	1446441	1618909	41
20	929498	1103126	1276417	1449319	1621779	40
21	932395	1106017	1279302	1452197	1624649	39
22	935291	1108908	1282187	1455075	1627519	38
23	938187	1111799	1285072	1457953	1630389	37
24	941083	1114590	1287957	1460831	1633259	36
25	943979	1117580	1290841	1463708	1636129	35
26	946875	1120471	1293726	1466586	1638999	34
27	949771	1123361	1296610	1469463	1641868	33
28	952667	1126252	1299495	1472340	1644738	32
29	955563	1129142	1302379	1475217	1647607	31
30	958458	1132032	1305262	1478094	1650476	30
	84	83	82	81	80	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	5	6	7	8	9	
30	958458	1132032	1305262	1478094	1650476	30
31	961354	1134922	1308146	1480971	1653345	29
32	964249	1137812	1311030	1483848	1656214	28
33	967144	1140702	1313914	1486724	1659082	27
34	970039	1143592	1316798	1489601	1661951	26
35	972934	1146482	1319681	1492477	1664819	25
36	975829	1149372	1322564	1495353	1667687	24
37	978724	1152261	1325447	1498229	1670555	23
38	981619	1155151	1328330	1501105	1673423	22
39	984514	1158040	1331213	1503981	1676291	21
40	987408	1160929	1334096	1506857	1679159	20
41	990303	1163818	1336979	1509733	1682027	19
42	993198	1166707	1339862	1512608	1684994	18
43	996092	1169596	1342744	1515484	1687761	17
44	698987	1172485	1345627	1518359	1690628	16
45	1001881	1175374	1248509	1521234	1693495	15
46	1004775	1178263	1351392	1524109	1696362	14
47	1007669	1181151	1354274	1526984	1699229	13
48	1010563	1184040	1357157	1529859	1702095	12
49	1013457	1186928	1360038	1532734	1704962	11
50	1016351	1189816	1362920	1535608	1707828	10
51	1019245	1192704	1365802	1538482	1710694	9
52	1022139	1195592	1368683	1541356	1713560	8
53	1025032	1198480	1371564	1544230	1716426	7
54	1027926	1201368	1374446	1547104	1719292	6
55	1030819	1204255	1377327	1549978	1722157	5
56	1033713	1207143	1380208	1552852	1725022	4
57	1036606	1210031	1383089	1555725	1727887	3
58	1039499	1212918	1385970	1558599	1730752	2
59	1042392	1215806	1388851	1561472	1733617	1
60	1045285	1218693	1391731	1564345	1736482	0
	84	83	82	81	80	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	10	11	12	13	14	
0	1736482	1908090	2079117	2249510	2419219	60
1	1739347	1910945	2081962	2252345	2422041	59
2	1742211	1913800	2084807	2255179	2424863	58
3	1745075	1916655	2087652	2258013	2427685	57
4	1747939	1919510	2090497	2260847	2430507	56
5	1750803	1922365	2093342	2263680	2433329	55
6	1753667	1925220	2096186	2266513	2436150	54
7	1756531	1928074	2099030	2269346	2438971	53
8	1759394	1930928	2101874	2272179	2441792	52
9	1762258	1933782	2104718	2275012	2444613	51
10	1765121	1936636	2107562	2277844	2447434	50
11	1767984	1939490	2110405	2280676	2450254	49
12	1770847	1942444	2113248	2283508	2453074	48
13	1773710	1945197	2116091	2286340	2455894	47
14	1776573	1948050	2118934	2289172	2458714	46
15	1779435	1950903	2121777	2292004	2461533	45
16	1782298	1953756	2124620	2294835	2464352	44
17	1785160	1956609	2127462	2297666	2467171	43
18	1788022	1959462	2130304	2300497	2469990	42
19	1790884	1962314	2133146	2303328	2472809	41
20	1793746	1965166	2135988	2306159	2475628	40
21	1796608	1968018	2138830	2308989	2478446	39
22	1799469	1970870	2141671	2311819	2481264	38
23	1802331	1973722	2144512	2314649	2484082	37
24	1805192	1976574	2147353	2317479	2486900	36
25	1808053	1979425	2150194	2320209	2489717	35
26	1810914	1982276	2153035	2323138	2492534	34
27	1813774	1985127	2155876	2325967	2495351	33
28	1816634	1987978	2158716	2328796	2498168	32
29	1819495	1990829	2161556	2331625	2500984	31
30	1822355	1993670	2164396	2334454	2503800	30
	79	78	77	76	75	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for righe Sines

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the right Sines of the arches of the ſame Quadrant.

	10	11	12	13	14	
30	1822355	1993679	2164396	2334454	2503800	30
31	1825215	1996530	2167236	2337282	2506616	29
32	1878075	1999380	2170076	2340110	2509432	28
33	1820935	2002230	2172916	2342938	2512248	27
34	1833795	2005080	2175755	2345766	2515064	26
35	1836654	2007930	2178594	2348593	2517879	25
36	1839513	2010780	2181433	2351421	2520694	24
37	1842372	2013629	2184272	2354248	2523509	23
38	1845231	2016478	2187111	2357075	2526324	22
39	1848090	2019327	2189949	2359902	2529138	21
40	1850949	2022176	2192787	2362729	2531952	20
41	1853808	2025025	2195625	2365555	2534766	19
42	1856666	2027874	2198463	2368381	2537580	18
43	1859524	2030722	2201300	2371207	2540393	17
44	1862382	2033570	2204137	2374033	2543206	16
45	1865240	2036418	2206974	2376859	2546019	15
46	1868098	2039266	2209811	2379684	2548832	14
47	1870956	2042114	2212648	2382509	2551645	13
48	1873813	2044962	2215485	2385334	2554458	12
49	1876670	2047809	2218322	2388159	2557270	11
50	1879527	2050656	2221158	2390983	2560082	10
51	1882384	2053503	2223994	2393808	2562894	9
52	1885241	2056350	2226830	2396632	2565706	8
53	1888098	2059197	2229666	2399456	2568517	7
54	1890955	2062043	2232502	2402280	2571328	6
55	1893810	2064889	2235337	2405104	2574139	5
56	1896666	2067735	2238172	2407927	2576950	4
57	1899522	2070581	2241007	2410750	2579760	3
58	1902378	2073427	2243841	2413573	2582570	2
59	1905234	2076272	2246675	2416306	2585380	1
60	1908090	2079117	2249510	2419219	2588190	0
	79	78	77	76	75	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	15	16	17	18	19	
0	2588190	2756373	2923717	3090170	3255682	60
1	2591000	2759169	2926499	3092936	3258432	59
2	2593809	2761965	2929280	3095702	3261182	58
3	2596618	2764761	2932061	3098468	3263931	57
4	2599427	2767556	2934842	3101234	3266681	56
5	2602236	2770351	2937623	3103999	3269430	55
6	2605045	2773146	2940403	3106764	3272179	54
7	2607853	2775941	2943182	3109529	3274927	53
8	2610661	2778735	2945963	3112294	3277675	52
9	2613469	2781529	2948743	3115058	3280423	51
10	2616277	2784323	2951523	3117822	3283171	50
11	2619084	2787117	2954302	3120586	3285918	49
12	2621891	2789911	2957081	3123349	3288665	48
13	2624698	2792704	2959860	3126112	3291412	47
14	2627505	2795497	2962638	3128875	3294159	46
15	2630312	2798290	2965416	3131638	3296906	45
16	2633118	2801082	2968194	3134400	3299652	44
17	2635924	2803874	2970973	3137162	3302398	43
18	2638730	2806666	2973750	3139924	3305144	42
19	2641536	2809458	2976527	3142686	3307889	41
20	2644342	2812250	2979304	3145448	3310634	40
21	2647147	2815041	2982081	3148209	3313379	39
22	2649952	2817832	2984857	3150970	3316123	38
23	2652757	2820623	2987633	3153731	3318867	37
24	2655562	2823414	2990409	3156491	3321611	36
25	2658366	2826204	2993185	3159251	3324355	35
26	2661170	2828994	2995960	3162011	3327098	34
27	2663974	2831784	2998735	3164770	3329841	33
28	2666777	2834574	3001510	3167529	3332585	32
29	2669580	2837364	3004284	3170288	3335327	31
30	2672382	2840153	3007058	3173047	3338069	30
	74	73	72	71	70	

The minutes of deg. of the Quadrant for right Sines of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	15	16	17	18	19	
30	2672383	2840153	3007058	3173047	3338069	30
31	2675186	2842942	3009822	3175805	3340811	29
32	2677989	2845731	3012606	3178563	3343553	28
33	2680792	2848520	3015380	3181221	3346294	27
34	2683595	2851308	3018153	3184079	3349035	26
35	2686397	2854096	3020926	3186837	3351776	25
36	2689199	2856884	3023699	3189594	3354516	24
37	2692001	2859672	3026472	3192351	3357256	23
38	2694802	2862459	3029244	3195108	3359996	22
39	2697603	2865246	3032016	3197864	3362736	21
40	2700404	2868033	3034788	3200620	3365475	20
41	2703205	2870819	3037559	3203375	3368214	19
42	2706005	2873605	3040330	3206130	3370953	18
43	2708805	2876391	3043101	3208885	3373691	17
44	2711605	2879177	3045872	3211640	3376429	16
45	2714406	2881963	3040643	3214395	3379167	15
46	2717204	2884748	3051413	3217150	3381905	14
47	2720003	2887533	3054183	3219904	3384642	13
48	2722802	2890318	3056953	3222658	3387379	12
49	2725601	2893103	3059723	3225412	3390116	11
50	2728400	2895888	3062492	3228165	3392852	10
51	2731198	2898672	3065261	3230918	3395588	9
52	2733996	2901456	3068030	3233671	3398324	8
53	2736794	2904240	3070798	3236423	3401060	7
54	2739592	2907023	3073566	3239175	3403795	6
55	2742389	2909806	3076334	3241927	3406530	5
56	2745186	2912589	3079102	3244679	3409265	4
57	2747983	2915371	3081869	3247430	3411999	3
58	2750780	2918153	3084636	3250181	3414733	2
59	2753577	2920935	3087403	3252932	3417467	1
60	2756373	2923717	3090170	3255682	3420201	0
	74	73	72	71	70	

The minutes of deg. of the Quadrant for right Sines of the complements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	20	21	22	23	24	
0	3420201	3583679	3746066	3907311	4067366	60
1	3422934	3586395	3748763	3909989	4070023	59
2	3425667	3589110	3751460	3912666	4072680	58
3	3428400	3591825	3754156	3915343	4075337	57
4	3431133	3594549	3756825	3918020	4077993	56
5	3433865	3597254	3859548	4920696	4080649	55
6	3436597	3599968	3762243	3923372	4083305	54
7	3439329	3622682	3764938	3926048	4085960	53
8	3442060	3605395	3767633	3928723	4088615	52
9	3444791	3608108	3770327	3931398	4091269	51
10	3447522	3610821	3773022	3934072	4093923	50
11	3450253	3613533	3775715	3936746	4096577	49
12	3452983	3616245	3778408	3939420	4099231	48
13	3455713	3618957	3781101	3942493	4101884	47
14	3458442	3621669	3783794	3944766	4104537	46
15	3461171	3624380	3786486	3947439	4107189	45
16	3463900	3627091	3789178	3950112	4109841	44
17	3466629	3629802	3791870	3952784	4112493	43
18	3469357	3632512	3794562	3955456	4115144	42
19	3472085	3635222	3767253	3958128	4117795	41
20	3474813	3637632	3799944	3960799	4120446	40
21	3477540	3640642	3802635	3963470	4123096	39
22	3480267	3643351	3805325	3966140	4125746	38
23	3482994	3646060	3808015	3968810	4128395	37
24	3485721	3648768	3813393	3971480	4131044	36
25	3488447	3651476	3813393	3974149	4133693	35
26	3491173	3654184	3816082	3976818	4136341	34
27	3493899	2656892	3818771	3976487	4138989	33
28	3496624	3659599	3821459	3983155	4141637	32
29	3469349	3062306	3824747	3984823	4144285	31
30	3562074	3265012	3626834	3987491	4146932	30
	20	68	67	66	65	

The degrees of the Quadrant for right Sines

The minutes of deg. of the Quadrant for right Sines of the cõplements of the arches of the ſame Quadrant.

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of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the right Sines of the arches of the ſame Quadrant.

	20	21	22	23	24	
30	3502074	3665012	3826834	3987491	4146932	30
31	3504799	3667718	3836521	3990159	4149597	29
32	3507524	3670424	3832208	3992826	4152226	28
33	3510247	3673130	3824895	3995493	4154872	27
34	3512971	3675835	3837581	3998159	4157518	26
35	3515694	3678541	3840267	4000825	4160163	25
36	3518417	3681246	3842953	4003491	4162808	24
37	3521140	3683951	3845638	4006156	4165453	23
38	3523862	3686655	3848323	4008821	4168097	22
39	3526584	3689159	3851008	4011486	4170741	21
40	3529306	3692062	3853692	4014150	4173385	20
41	3532027	3694765	3856376	4016814	4176028	19
42	3534748	3697408	3859060	4019478	4178671	18
43	3537469	3700170	3861743	4022141	4171212	17
44	3540190	3702872	3864426	4024804	4183955	16
45	3542910	3705574	3867109	4027467	4186597	15
46	3545630	3708276	3869791	4030130	4189239	14
47	3548350	3710977	3872473	4032792	4191880	13
48	3551070	3713678	3865155	4035454	4164521	12
49	3553789	3716279	3877837	4038115	4187162	11
50	3556508	3719080	3880518	4040776	4169802	10
51	3559227	3721780	3883199	4043437	4202442	9
52	3561945	3724480	3885880	4046097	4205081	8
53	3564663	3727179	3888560	4048757	4207720	7
54	3567380	3729878	3891240	4051416	4210359	6
55	3570097	3732577	3893919	4054075	4212997	5
56	3572814	3735275	3896598	4056734	4215635	4
57	3575531	3737973	3896277	4059392	4218273	3
58	3578247	3740671	3901955	4062050	4220910	2
59	3580963	3743369	3904633	4064708	4223547	1
60	3583679	3746066	3907311	4067266	4226183	0
	69	68	67	66	65	

of the complements of the arches of the ſame Quadrant.

The minutes of deg. of the Quadrant for right Sines of the coplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	25	26	27	28	29	
0	4226183	4383712	4539905	4694716	4848096	60
1	4228819	4386326	4542497	4697284	4850640	59
2	4231455	4388940	4545088	4699825	4853184	58
3	4234090	4391553	4547679	4702416	4855727	57
4	4236725	4394167	4550270	4704986	4858270	56
5	4239360	4396780	4552860	4707553	4860812	55
6	4241994	4399392	4555450	4710116	4863354	54
7	4244628	4402004	4558039	4712685	4865895	53
8	4247265	4404626	4560628	4715250	4868436	52
9	4249895	4407227	4563216	4717815	4870977	51
10	4252528	4409838	4565804	4720380	4873517	50
11	4255161	4412449	4568392	4722944	4876057	49
12	4257793	4415059	4570979	4725508	4878596	48
13	4260425	4417669	4573566	4728071	4881135	47
14	4263056	4420279	4576158	4730634	4883674	46
15	4265687	4422888	4578740	4733197	4886212	45
16	4268318	4425496	4581325	4735759	4888750	44
17	4270949	4428104	4583911	4738321	4981287	43
18	4273579	4430712	4586496	4740882	4893824	42
19	4276209	4433320	4589081	4743442	4896361	41
20	4278838	4435927	4591665	4746004	4898897	40
21	4281467	4438534	4594249	4748564	4901433	39
22	4284096	4441140	4596833	4751124	4903968	38
23	4286724	4443746	4599416	4753683	4906503	37
24	4289352	4446352	4601999	4756242	4909037	36
25	4291970	4448957	4604581	4758801	4911571	35
26	4294606	4451562	4607163	4761359	4914105	34
27	4297232	4454167	4609744	4763917	4916638	33
28	4299859	4456771	4612325	4766474	4919171	32
29	4302485	4459375	4614906	4769031	4921793	31
30	4305111	4461978	4617486	4771588	4924235	30
	64	63	62	61	60	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the right Sines of the arches of the ſame Quadrant.

	25	26	27	28	29	
30	4305111	4461978	4617486	4771188	4924235	30
31	4307736	4464581	4620066	4771144	4926767	29
32	4310361	4467184	4622640	4776700	4929298	28
33	4312986	4460786	4625225	4779255	4931829	27
34	4315610	4472388	4627804	4781810	4934359	26
35	4318234	4474990	4630382	4784365	4936889	25
36	4320858	4477591	4632960	4786919	4939418	24
37	4322481	4580192	4635538	4880473	4941947	23
38	4326104	4482792	4638115	4792026	4944476	22
39	4328726	4485392	4640692	4704579	4947004	21
40	4331348	4487992	4643268	4797132	4949532	20
41	4332970	4490591	4645844	4799684	4952059	19
42	4336591	4493190	4648420	4702236	4954586	18
43	4339212	4495788	4650995	4804787	4957113	17
44	4341833	4498386	4653570	4807338	4959639	16
45	4344453	4500984	4656145	4809888	4962165	15
46	4347073	4503582	4658719	4812438	4964690	14
47	4349693	4506179	4661293	4814988	4967215	13
48	4352312	4508776	4663866	4817537	4969740	12
49	4354931	4511372	4666429	4820086	4972264	11
50	4357549	4513968	4669012	4822635	4974788	10
51	4360167	4516563	4671584	4825183	4977311	9
52	4362785	4519158	4674156	4827731	4979834	8
53	4365401	4521753	4676727	4830278	4982356	7
54	4368019	4524347	4679298	4832825	4984878	6
55	4370625	4526941	4681869	4835371	4987399	5
56	4373251	4529535	4684429	4837917	4989920	4
57	4375867	4532128	4687099	4840462	4992441	3
58	4378482	4534721	4689578	4843007	4994961	2
59	4381097	4537313	4692147	4845553	4997481	1
60	4383712	4539905	4604716	4848096	5000000	0
	64	63	62	61	60	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	30	31	32	33	34	
	5000000	5150381	5299192	5446390	5591929	60
1	5002519	5152874	5301659	5448829	5594340	59
2	5005038	5155367	5304125	5451268	5596751	58
3	5007556	5157859	5306591	5453707	5599161	57
4	5010074	5160351	5309056	5456145	5601571	56
5	5012591	5162842	5311521	5458583	5603981	55
6	5015108	5175334	5313685	5461020	5606390	54
7	5017624	5177825	5316449	5463456	5608798	53
8	5020140	5170315	5318913	5465892	5611206	52
9	5022656	5172805	5321376	5468328	5613614	51
10	5025171	5175294	5323839	5470763	5616021	50
11	5027686	5177782	5326301	5473198	5618427	49
12	5030200	5180271	5328703	5475632	5620833	48
13	5032714	5182759	5331224	5478066	5623239	47
14	5035227	5185246	5333685	5480499	5625604	46
15	5037740	5187723	5336145	5482932	5628049	45
16	5040253	5190220	5338605	5484364	5630453	44
17	5042765	5162706	5341065	5487796	5632857	43
18	5045277	5195192	5343524	5490228	5635260	42
19	5047788	5167677	5345693	5492659	5637663	41
20	5050299	5200162	5348441	5495090	5640006	40
21	5052809	5202646	5350899	5497519	5642468	39
22	5055319	5205130	5353357	5499950	5644869	38
23	5057829	5207614	5355814	5502379	5647270	37
24	5060338	5210007	5358269	5504808	5649670	36
25	5062847	5212580	5360724	5507236	5652070	35
26	5065355	5215062	5363179	5509664	5654469	34
27	5067863	5217544	5365634	5512001	5656868	33
28	5070370	5220025	5368088	5514518	5659266	32
29	5072877	5222506	5370542	5516944	5661664	31
30	5075384	5224986	5372996	5519370	5664062	30
	59	58	57	56	55	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	30	31	32	33	34	
30	5075384	5224986	5372996	5519370	5664062	30
31	5077890	5227466	5375449	5521795	5666459	29
32	5080396	5229946	5377902	5524220	5668856	28
33	5082901	5232425	5380354	5526645	5671252	27
34	5085406	5234904	5382806	5529069	5673648	26
35	5087911	5237382	5385258	5531493	5676043	25
36	5090415	5239860	5387709	5533916	5678438	24
37	5092919	5242337	5390159	5536338	5680832	23
38	5095422	5244814	5392609	5538760	5683226	22
39	5097925	5247290	5395958	5541182	5685619	21
40	5100427	5249766	5397507	5543603	5688012	20
41	5102929	5252241	6399955	5546024	5690404	19
42	5105430	5254716	5402403	5548444	5692796	18
43	5107931	5297191	5404851	5550864	5605187	17
44	5110431	5259665	5407298	5553283	5697578	16
45	5112931	5262139	5409745	5555702	5699968	15
46	5115431	5264612	5412191	5558120	5702358	14
47	5117630	5267085	5414637	5560538	5704747	13
48	5120429	5269557	5417082	5562956	5707136	12
49	5112927	5272029	5419527	5595373	5709524	11
50	5125425	5274501	5421972	5567780	5711912	10
51	5127922	5276972	5424416	5570206	5714299	9
52	5230419	5279443	5426859	5572622	5716686	8
53	5132916	5281913	5429302	5575037	5719072	7
54	5135412	5284383	5431745	5577452	5721458	6
55	5137908	5286852	5434187	5579866	5723844	5
56	5140403	5289321	5436629	5582280	5726229	4
57	5142898	5291789	5439070	5584693	5728613	3
58	5145393	5294257	5441510	5587106	5730997	2
59	5147887	5296725	5443950	5589518	5733381	1
60	5150381	5299192	5446390	5591929	5735764	0
	59	58	57	56	55	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	35	36	37	38	39	
0	5735764	5877852	6018150	6156615	6293204	60
1	5738147	5880205	6020473	6158907	6295464	59
2	5740529	5882558	6022766	6161198	6297724	58
3	5742911	5884910	6025118	6163489	6299983	57
4	5745292	5887262	6027439	6165780	6302242	56
5	5747672	5889613	6029760	6168070	6304501	55
6	5750052	5891964	6032080	6170359	6306759	54
7	5752422	5894315	6034400	6172648	6309016	53
8	5754811	5896665	6036719	6174936	6311273	52
9	5757190	5899014	6039038	6177224	6313529	51
10	5759568	5901361	6041357	6179512	6315784	50
11	5761946	5903709	6043675	6181799	6318039	49
12	5764323	5906056	6045992	6184085	6320293	48
13	5766700	5908403	6048309	6186371	6322547	47
14	5769076	5910750	6050625	6188656	6334800	46
15	5771452	5913096	6052640	6190940	6327053	45
16	5773827	5915442	6055255	6193224	6329305	44
17	5776202	5917787	6057570	6195508	6331557	43
18	5778576	5920132	6059884	6197791	6333808	42
19	5780950	5922476	6062198	6200074	6336059	41
20	5783324	5924820	6064511	6202356	6338310	40
21	5785697	5927163	6066824	6204638	6340560	39
22	5788069	5929506	6069136	6206919	6342809	38
23	5790441	5931847	6071448	9209199	6345058	37
24	5792812	5934189	6673759	6211479	6347306	36
25	5795183	5936530	6076069	6213758	6349553	35
26	5797553	5638871	6678379	6216037	6351800	34
27	5799923	5941211	6080688	6218315	6354046	33
28	5802292	5943551	6082997	6220593	6356292	32
29	5804661	5945890	6085206	6222870	6358537	31
30	5807030	5948228	6087614	6225146	6360782	30
	54	53	52	51	50	

The minutes of deg. of the Quadrant for right Sines of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	35	36	37	38	39	
30	5807030	5948228	6087614	6215146	6360782	30
31	5809398	5950566	6089922	6227422	6363026	29
32	5811766	5952904	6092229	6229698	6365270	28
33	5814133	5955241	6094536	6231973	6367513	27
34	5816499	5957578	6096842	6234248	6369756	26
35	5818865	5959914	6099147	6236522	6371999	25
36	5821230	5962250	6101452	6238796	6374241	24
37	5823595	5964585	6103756	6241069	6376482	23
38	5825959	5966919	6106060	6243342	6378722	22
39	5828323	5969253	6108364	6245614	6380962	21
40	5830687	5971586	6110667	6247885	6383211	20
41	5833050	5973919	6112970	6240156	6385440	19
42	5835412	5976251	6115272	6252426	6387678	18
43	5837774	5978583	6117573	6254696	6389910	17
44	5840136	5980915	6119873	6256966	6392153	16
45	5842497	5983246	6122173	6259235	6394390	15
46	5844858	5985577	6124478	6261503	6396626	14
47	5847218	5997907	6126772	6263771	6398862	13
48	5849578	5990237	6129071	6266038	6401097	12
49	5851937	5992566	6131369	6268305	6403332	11
50	5854295	5994894	6133667	6267572	6405566	10
51	5856653	5997222	6135964	6272838	6407799	9
52	5859010	5999549	6138261	7275103	6410032	8
53	5861367	6001876	6140557	6277368	6412264	7
54	5873724	6004202	6142853	6279632	6414496	6
55	5866080	6006528	6145148	6201895	6416729	5
56	5868436	6008853	6147142	6284158	6418959	4
57	5870791	6011178	6149736	6286420	6421189	3
58	5873145	6013502	6152030	6288682	6423919	2
59	5875499	6015826	6154323	6290942	6425648	1
60	5877852	6018150	6156615	6293204	6427876	0
	54	53	52	51	50	

The minutes of deg. of the Quadrant for right Sines of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	40	41	42	43	44	
0	6427876	6560590	6691306	6819984	6946584	60
1	6430104	6562785	6693468	6822111	6948676	59
2	6432331	6564979	6695629	6824237	6950767	58
3	6434558	6567173	6697789	6826363	6952858	57
4	6436785	6569367	6699949	6828489	6954949	56
5	6439011	6571560	6702108	6830614	6957036	55
6	6441236	6573753	6704267	6832738	6959128	54
7	6443461	6575945	6706425	6634861	6961216	53
8	6445685	6578136	6708582	6836984	6963304	52
9	6447909	6580326	6710739	6839107	6965392	51
10	6450132	6582516	6712895	6841229	6967479	50
11	6452355	6584795	6715051	6843350	6969565	49
12	6454577	6586894	6717206	6845471	6971651	48
13	6456799	6589082	6719361	6847591	6973736	47
14	6459020	6591270	6721515	6849711	6975821	46
15	6461240	6593458	6723668	6851839	6977905	45
16	6463460	6595645	6725821	6853947	6979988	44
17	6465679	6597831	6727973	6856067	6982071	43
18	6467898	6600016	6730125	6858184	6984153	42
19	6470116	6602201	6732276	6660301	6986235	41
20	6472333	6604386	6734426	6862417	6988316	40
21	6474550	6606570	6736577	6864533	6990396	39
22	6476766	6608753	6738727	6866648	6992476	38
23	6478982	6610936	6740875	6868762	6994555	37
24	6481198	6613118	6743024	6870876	6996634	36
25	6483413	6615300	6745172	6872989	6998712	35
26	6485928	6617481	6747319	6875102	7000789	34
27	6487842	6619661	6749465	6877214	7002866	33
28	6490055	6621841	6751611	6879325	7004942	32
29	6492268	6624021	6753757	6881436	7007018	31
30	6494489	6626200	6755902	6883546	7009093	30
	49	48	47	46	45	

The minutes of deg. of the Quadrant for right Sines of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	40	41	42	43	44	
30	6494480	6626200	6755902	6883546	7009093	30
31	6496692	6628379	6758047	6885656	7011167	29
32	6498903	6630557	6760191	6887765	7013241	28
33	6501114	6632734	6762334	6889874	7615314	27
34	6503324	6634911	6764477	6891982	7017387	26
35	6505533	6637087	6766619	6894089	7019459	25
36	6507742	6639263	6768760	6896196	7021530	24
37	6509950	6641438	6770901	6898302	7023601	23
38	6512158	6643612	6773041	6900408	7025671	22
39	6514365	6645786	6775181	6902513	7027741	21
40	6516572	6647959	6777320	6904617	7029810	20
41	6518778	6650132	6779459	6906721	7031879	19
42	6520984	6652304	6781597	6908824	7033947	18
43	6523189	6654476	6783734	6910927	7036014	17
44	6525394	6656647	6785871	6913029	7038081	16
45	6527598	6658817	6788007	6915131	7040147	15
46	6529801	6660987	6790143	6917232	7042213	14
47	6532004	6663156	6792378	6919332	7044278	13
48	6534200	6665325	6794413	6921432	7046342	12
49	6536408	6667493	6796547	6923531	7048406	11
50	6548609	6669661	6798681	6925630	7050469	10
51	6540809	6671828	6800814	6927728	7052832	9
52	6543009	6673994	6802946	6929825	7054594	8
53	6545208	6676160	6805078	6931922	7056655	7
54	6547407	6678326	6807209	6934018	7058716	6
55	6549606	6680491	6809240	6936114	7060776	5
56	6551804	6682655	6811470	6938209	7062836	4
57	6554001	6684818	6813599	9940303	7064895	3
58	6556198	6686981	6815728	6942397	706695	2
59	6558294	6689144	6817856	6944491	706901	1
60	6560590	6691206	6819984	6946584	7071068	0
	49	48	47	46	45	

The minutes of deg. of the Quadrant for right Sines of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	45	46	47	48	49	
0	7071068	7193398	7313537	7431448	7547096	60
1	7073125	7195418	7315521	7433394	7549004	59
2	7075181	7197438	7317504	7435339	7550911	58
3	7077236	7199457	7319486	7437284	7552818	57
4	7079291	7201470	7321468	7539229	7554724	56
5	7081345	7203494	7323449	7441173	7556930	55
6	7083399	7205511	7325429	7443116	7558535	54
7	7085452	7207527	7327409	7445058	7560430	53
8	7087504	7209543	7329388	7447000	7562343	52
9	7089556	7211559	7331367	7448941	7364246	51
10	7091607	7213574	7333345	7450882	7566148	50
11	7093658	7215588	7335322	7462822	7568050	49
12	7095708	7217601	7335298	7454761	7569951	48
13	7097757	7219614	7339274	7456699	7570851	47
14	7099806	7221627	7341250	7458637	7573751	46
15	7101854	7223639	8343225	7460574	7575650	45
16	7103902	7225651	7345199	7462511	7577548	44
17	7105949	7227662	7347173	7464447	7570446	43
18	7107995	7229672	7349146	7466382	7581343	42
19	7110641	7231681	7351118	7468317	7581240	41
20	7112086	7233689	7353090	7470251	7583136	40
21	7114131	7235697	7355061	7472184	7587031	39
22	7116175	7237704	7357031	7474117	7588925	38
23	7118218	7239711	7359001	7476049	7590819	37
24	7120261	7241718	7360970	7477981	7592713	36
25	7122303	7243724	7362939	7479912	7594606	35
26	7124344	7245729	7364907	7481842	7596498	34
27	7126385	7247733	7366874	7483771	7598284	33
28	7128425	7249737	7368841	7485700	7600280	32
29	7130465	7251741	7370807	7487628	7602170	31
30	7132504	7253744	7372772	7489555	7604090	30
	44	43	42	41	40	

The minutes of deg. of the Quadrant for right Sines of the cöplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	45	46	47	48	49	
30	7132504	7253744	7372773	7489556	7604060	30
31	7134543	7255746	7374738	7491484	7605949	29
32	7136581	7257747	7376702	7493410	7607837	28
33	7138618	7259748	7378666	7495336	7609725	27
34	7140655	7261740	7380629	7497282	7611612	26
35	7142691	7263749	7382592	7499187	7613498	25
36	7144727	7265748	7384554	7501111	7615384	24
37	7146762	7267746	7386515	7503034	7617269	23
38	7148796	7269744	7388475	7504957	7619153	22
39	7150830	7271741	7390435	7506879	7621037	21
40	7152863	7273737	7392394	7508801	7622920	20
41	7154895	7275733	7394353	7510722	7624802	19
42	7156927	7277728	7396311	7512642	7626763	18
43	7158958	7279722	7398268	7514561	7628564	17
44	7160989	7281716	7400225	7516480	7630445	16
45	7163019	7282710	7402181	7518393	7632325	15
46	7165049	7285703	7404137	7520316	7634204	14
47	7167078	7287695	7406092	7522223	7636082	13
48	7169106	7289687	7408046	7523449	7637969	12
49	7171134	7291678	7410000	7526065	7639838	11
50	7163161	7293668	7411953	7527980	7641715	10
51	7175187	7295658	7413905	7529894	7643591	9
52	7177213	7297647	7415856	7531808	7645466	8
53	7179238	7299635	7417807	7533721	7647341	7
54	7181263	7301623	7419758	7435634	7649215	6
55	7182287	7303610	7421708	7537546	7651088	5
56	7185310	7305597	7423657	7539457	7652961	4
57	7187333	7307583	7425605	7541367	7654833	3
58	7189355	7309568	7427552	7543277	7656704	2
59	7191377	7311553	7420501	7545187	7958575	1
60	7193398	7313537	7431448	7547096	7660445	0
	44	43	42	41	40	

The minutes of deg. of the Quadrant for right Sines of the cöplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	50	51	52	53	54	
0	7660445	7771460	7880108	7986355	8090170	60
1	7662314	7773290	7881898	7988105	8091879	59
2	7664183	7775120	7883688	7989855	8093588	58
3	7666051	7776949	7885477	7991604	8095296	57
4	7667919	7778777	7887266	7993352	8097004	56
5	7669786	7780605	7889054	7995100	8098711	55
6	7671652	7782432	7890841	7996847	8100417	54
7	7673517	7784258	7892627	7998593	8102122	53
8	7675382	7786084	7894413	8000339	8103827	52
9	7677246	7787909	7896198	8002084	8105531	51
10	7679110	7789733	7897983	8003828	8107234	50
11	7680973	7791557	7899767	8005571	8108936	49
12	7682835	7793380	7901550	8007314	8110638	48
13	7684697	7795202	7903332	8009056	8112339	47
14	7686558	7797024	7905114	8010797	8114040	46
15	7688418	7798845	7906895	8012538	8115740	45
16	7690278	7800665	7908676	8014278	8117439	44
17	7692137	7802485	7910456	8016017	8119137	43
18	7693995	7804304	7912235	8017756	8120835	42
19	7695853	7806123	7914014	8019494	8122532	41
20	7697710	7807941	7915792	8021232	8124229	40
21	7699566	7809758	7917569	8022969	8125925	39
22	7701422	7811574	7919345	8024705	8127620	38
23	7703277	7813390	7921121	8026440	8129314	37
24	7705132	7815205	7922896	8022175	8131008	36
25	7706086	7817020	7924671	8029909	8132701	35
26	7708839	7828834	7926445	8031642	8134393	34
27	7710692	7820647	7928218	8033375	8136084	33
28	7712544	7822459	7929990	8035107	8137775	32
29	7714395	7824271	7931762	8036828	8139465	31
30	7716246	7826082	7933532	8038569	7141155	30
	39	38	37	36	35	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sin es

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of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	50	51	52	53	54	
30	7716246	7826082	7933533	8038569	8141155	30
31	7718096	7827892	7935303	8040299	8142844	29
32	7719945	7829702	7937073	8042028	8144532	28
33	7721794	7831511	7938842	8043757	8146220	27
34	7723642	7833320	7940611	8045485	8147907	26
35	7725490	7835128	7942379	8047212	8149593	25
36	7727337	7836935	7944146	8048938	8151278	24
37	7729183	7838741	7945912	8050664	8152963	23
38	7731028	7840547	7947678	8052389	8154647	22
39	7732872	7842352	7949443	8054114	8156330	21
40	7734716	7844157	7951208	8055838	8158013	20
41	7736559	7845961	7952972	8057561	8159695	19
42	7738402	7847764	7954735	8059283	8161376	18
43	7740244	7849566	7956497	8061005	8163057	17
44	7742085	7851368	7958259	8062726	8164737	16
45	7743926	785[illegible]69	7960020	8064446	8166416	15
46	7745766	7854970	7961780	8066166	8168094	14
47	7747606	7856770	7963540	8067885	8169772	13
48	7749445	7858569	7965299	8069623	8171449	12
49	7751283	7860368	7967057	8071321	8173126	11
50	7753121	7862166	7968815	8073038	8174802	10
51	7754958	7893963	7970572	8074754	8176477	9
52	7756794	7865759	7972328	8076470	8178151	8
53	7758630	7867555	7974084	8078185	8179825	7
54	7760465	7869350	7975839	8079899	8181498	6
55	7762299	7871145	7977593	8081613	8183170	5
56	7764132	7872939	7979347	8083326	8184841	4
57	7765965	7874732	7981100	8085038	8186512	3
58	7767797	7876525	7982852	8086749	8188182	2
59	7769629	7878317	7984604	8088460	8189851	1
60	7771460	7880108	7986355	8090170	8191520	0
	39	38	37	36	35	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	55	56	57	58	59	
0	8191520	8296376	8386706	8480481	8571673	60
1	8193188	8292003	8388290	8482022	8573171	59
2	8194855	8293628	8389873	8483562	8574668	58
3	8196522	8295253	8391456	8485102	8576164	57
4	8198188	8296877	8393038	8486641	8577660	56
5	8199854	8298501	8394619	8488180	8579155	55
6	8201519	8300124	8396199	8489718	8580049	54
7	8203183	8301746	8397778	8401255	8582142	53
8	8204846	8303367	8399357	8492791	8583635	52
9	8206508	8304987	8400935	8494326	8585127	51
10	8208170	8306607	8402513	8495860	8580619	50
11	8209831	8308226	8404090	8497394	8588110	49
12	8211491	8309844	8405666	8498927	8589600	48
13	8213151	8311463	8407241	8500459	8591089	47
14	8214810	8313079	8408816	8501991	8592577	46
15	8216469	8314696	8410390	85[illegible]522	8594064	45
16	8218127	8316312	8411963	8505042	8593551	44
17	8219784	8317927	8413536	8506582	8597037	43
18	8221440	8319541	8415108	8505111	8598523	42
19	8223096	8321155	8416679	8509630	8600008	41
20	8224751	8322768	8418250	8511167	8601492	40
21	8226405	8324380	8419820	8512694	8602975	39
22	8228058	8325991	8421389	8514220	8604457	38
23	8229711	8327602	8422957	8515745	8605939	37
24	8231363	8329212	8424525	8517270	8607420	36
25	8233015	8330822	8426092	8518794	8608901	35
26	8234666	8332431	8424658	8520317	8610381	34
27	8236316	8334039	8429223	8521839	8611860	33
28	8237965	8335646	8430788	8521361	8613338	32
29	8239614	8337253	8432353	8524882	8614815	31
30	8241262	8338858	8433915	8526402	8616292	30
	34	33	32	31	30	

The degrees of the Quadrant for right Sines

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	55	56	57	58	59	
30	8241262	8338858	8433915	8526402	8616292	30
31	8242909	8340462	8435477	8527921	8617768	29
32	8244556	8342076	8437039	8526440	8619243	28
33	8246202	8343671	8438600	8530658	8620718	27
34	8247847	8345274	8440161	8532476	8622192	26
35	8249492	8346877	8441721	8533993	8623665	25
36	8251136	8348479	8443280	8535509	8625137	24
37	8252779	8350080	8444838	8537024	8626608	23
38	8254421	8351680	8446396	8538538	8628079	22
39	8256062	8353279	8447953	8540052	8629549	21
40	8257703	8354678	8447653	8541565	8631019	20
41	8255343	8356476	8451664	8543077	8631488	19
42	8260982	8358073	8452618	8544588	8633956	18
43	8262621	8359670	8454172	8546099	8635423	17
44	8264259	8361266	8455725	8547609	8636889	16
45	8265897	8362862	8457278	8549116	8638355	15
46	8267534	8364457	8458830	8550628	8639820	14
47	8269170	8366051	8460381	8552136	8631284	13
48	8270806	8367644	8461932	8553643	8642748	12
49	8272441	8369236	8463482	8555149	8644211	11
50	8274075	8370828	8465031	8556655	8645673	10
51	8275708	8372419	8466579	8558160	8647134	9
52	8277340	8374009	8468126	8459664	8648595	8
53	8278972	8375599	8469673	8561168	8650055	7
54	8280603	8377188	8471219	8562671	8651514	6
55	8282234	8378776	8472765	8564173	8652973	5
56	8283864	8380363	8474310	8565675	8654431	4
57	8285493	8381956	8475854	8567176	8655888	3
58	8287121	8383536	8477397	8568676	8657344	2
59	8288749	8385121	8478939	8570175	8658799	1
60	8290376	8386706	8480481	8571673	8660254	0
	34	33	32	31	30	

of the complements of the arches of the ſame Quadrant.

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	60	61	62	63	64	
0	8660254	8746197	8829476	8910065	8987940	60
1	8661708	8747607	8830841	8911385	8989125	59
2	8663162	8749016	8833205	8912704	8990489	58
3	8664615	8750425	8833569	8914023	8991762	57
4	8666067	8751833	8834932	8915341	8993035	56
5	8667518	8753240	8836195	8916659	8994307	55
6	8668968	8754646	8837657	8917976	8995578	54
7	8670417	8756051	8839018	8919292	8996848	53
8	8671866	8757456	8840378	8920607	8998117	52
9	8673314	8758860	8841737	8921921	8999386	51
10	8674762	8760263	8843095	8923234	9000654	50
11	8676209	8761665	8844452	8924546	9001921	49
12	8677655	8763067	8845809	8925858	9003187	48
13	8679100	8764468	8847165	8927169	9004453	47
14	8680544	8765868	8848521	8928479	9005718	46
15	8681988	8767268	8849876	8928789	9006982	45
16	8683431	8768667	8851230	8931098	9008245	44
17	8684874	8770065	8852583	8933406	9009508	43
18	8686316	8771462	8853930	8933714	9010770	42
19	8687757	8772859	8855288	8935021	9012031	41
20	8689197	8774255	8856639	8936327	9013292	40
21	8690636	8775650	8857089	8937632	9014552	39
22	8692074	8777044	8859338	8938936	9015811	38
23	8693512	8778437	8850687	8940240	9017069	37
24	8694949	8779830	8862035	8941543	9018326	36
25	8696386	8781222	8863283	8942845	9010582	35
26	8697822	8782013	8864780	8944146	9020838	34
27	8699257	8784003	8866076	8945446	9022093	33
28	8700691	8785393	8867421	8946746	9023347	32
29	1702124	8786782	8868765	8948045	9024600	31
30	8702557	8788171	8870108	8949344	9025853	30
	29	28	27	26	25	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

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of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	60	61	62	63	64	
30	8793557	8788171	8870108	8949344	9025853	30
31	8704989	8789559	8871451	8950642	9027105	29
32	8706420	8790946	8872793	8951939	9028356	28
33	8707851	8792332	8874134	8953235	9029606	27
34	8709281	8793717	8875475	8954530	9030956	26
35	8710710	8795102	8876815	8955824	9032105	25
36	8712138	8796486	8878154	8957117	9033353	24
37	8713565	8797869	8879492	8958410	9034600	23
38	8714992	8799251	8880830	8959702	9035847	22
39	8716418	8800633	8882167	8960994	9037093	21
40	8717844	8802014	8883503	8962285	9038338	20
41	8719269	8803394	8884838	8963575	9039582	19
42	8720693	8804773	8886172	8964864	9040825	18
43	8722116	8806152	8887506	8966152	9042068	17
44	8723538	8807530	8888839	8967440	9043310	16
45	8724960	8868907	8890171	8968727	9044551	15
46	8726381	8810283	8891502	8970013	9045791	14
47	8727801	8811659	8892833	8971299	9047031	13
48	8729221	8813034	8894163	8972584	9048270	12
49	8730640	8814408	8895492	8973868	9049508	11
50	8732058	8815782	8896821	8975151	9050746	10
51	8733475	8817155	8898149	8976433	9051983	9
52	8734891	8818527	8899476	8977715	9053219	8
53	8736307	8819898	8900802	8978996	9054454	7
54	8737722	8821268	8902127	8980276	9055688	6
55	8739137	8822638	8903452	8981555	9056922	5
56	8740551	8824007	8904776	8982833	9058155	4
57	8741964	8825375	8906099	8984111	9059387	3
58	8743376	8826743	8907422	8985388	9060618	2
59	8744787	88·8110	8908744	8986664	9061848	1
60	8746197	8829476	8910065	8987940	9062078	0
	29	28	27	26	25	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	65	66	67	68	69	
0	6063078	9135455	9205049	9271839	9335804	60
1	9064307	9136638	9206185	9272928	9336846	59
2	9065535	9137820	9207321	9274017	9337887	58
3	9066763	9139002	9208456	9275105	9338928	57
4	9067990	9140181	9209590	9276192	9339968	56
5	9069216	9141361	9210723	9277278	9341007	55
6	9070441	9142540	9211855	9278363	9342045	54
7	9071665	9143718	9212986	9279448	9343082	53
8	9072889	9144895	9214117	9280532	9344119	52
9	9074112	9146072	9215247	9281615	9345155	51
10	9075334	9147248	9216376	9282697	9346190	50
11	9076555	9448423	9217504	9283778	9347224	49
12	9077775	9149597	9218631	9284459	9348257	48
13	9078995	9150770	9219758	9285939	9349289	47
14	9080214	9151943	9220884	9287018	9359321	46
15	9081432	9153115	9222010	9288096	9351352	45
16	9082649	9154286	9223195	9283173	9352382	44
17	9083866	9155457	9224259	9290250	9353411	43
18	9085082	9156627	9225382	9291326	9354440	42
19	9086297	9157796	9226504	9292491	9355468	41
20	9087512	9158964	9227625	9293476	9356495	40
21	9088726	9160121	9228746	9294550	9357521	39
22	9089939	9161297	9229866	9295623	9358546	38
23	9091151	9162463	9230985	9296695	9359571	37
24	9062362	9163628	9232103	9297766	9360595	36
25	9092572	9164792	9233220	9298836	9361618	35
26	9094781	9165955	9234337	9299905	9362640	34
27	9095990	9167117	9235453	9200974	9363663	33
28	9097198	9168279	9236568	9302043	9364683	32
29	9098406	9169440	9237682	9303109	9365703	31
30	9099613	9170601	9238795	9204170	9366722	30
	24	23	22	21	20	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	65	66	67	68	69	
30	9099613	9170601	9238795	9304170	9366722	30
31	9100819	9171761	9239908	9305242	9367740	29
32	9102024	9172920	9241020	9306307	9368758	28
33	9102228	9174078	9242131	9307371	9369775	27
34	9104432	9175235	9243242	9308434	9370791	26
35	9105635	9176391	9244352	9309497	9371806	25
36	9106837	9177547	9245461	9310559	9372820	24
37	9108038	9178702	9246569	9311620	9373834	23
38	9109238	9179856	9247676	9312680	9374847	22
39	9110438	9181909	9248782	9313739	9375859	21
40	9111637	9182161	9249888	9314798	9376870	20
41	9113835	9183312	9250992	9315856	9377880	19
42	9114032	9184464	9252097	9316913	9378889	18
43	9115229	9185614	9253200	9317969	9379898	17
44	9116425	9186763	9254303	9319024	9380906	16
45	9117620	9187912	9255405	9320079	9381913	15
46	9118814	9189060	9256506	9321133	9382619	14
47	9120007	9190207	9257606	9322186	9383925	13
48	9121200	9191353	9258706	9323238	9384930	12
49	9122392	9192490	9259805	9324290	9385934	11
50	9123584	9193644	9260903	9325341	9386937	10
51	9124775	9194788	9262000	9326391	9387939	9
52	9125965	9195931	9263096	9327440	9388041	8
53	9127154	9197073	9264192	9328488	9389942	7
54	9128342	9198215	9265287	9329535	9390942	6
55	9129529	9199356	9266381	9330582	9391941	5
56	9130716	9200496	9267474	9331628	9392940	4
57	9131902	9201635	9268566	9332673	9393938	3
58	9133087	9202774	9269658	9333717	9394935	2
59	9134271	9203912	9270749	9334761	9395931	1
60	9135455	9205049	9271839	9335804	9396926	0
	24	23	22	21	20	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	70	71	72	73	74	
0	9396926	9455186	9510565	9563048	9612617	60
1	9397921	9456133	9511464	9563898	9612418	59
2	9398915	9457079	9512362	9564747	9614219	58
3	9399908	9458024	9513259	9565596	9615019	57
4	9400900	9458968	9514155	9566444	9615816	56
5	9401891	9457711	9515050	9567291	9616616	55
6	9402882	9460854	9515944	9568137	9618409	54
7	9402872	9461796	9516838	9568982	9618209	53
8	9404861	9462737	9517731	9569826	9619005	52
9	9405849	9463677	9518623	9570670	9619800	51
10	9406836	9464618	9519514	9571513	9620594	50
11	9407622	9465555	9520404	9572355	9621387	49
12	9408808	9466493	9521294	9573196	9622179	48
13	9409793	9467439	9522183	9574036	9622971	47
14	9410777	9468366	9523978	9574875	9623762	46
15	9411760	9469301	9523958	9575714	9624552	45
16	9412742	9470236	9524844	9576552	9625341	44
17	9413724	9471170	9525730	9577389	9626129	43
18	9414705	9472103	9526615	9578225	9626917	42
19	9415685	9473035	9527499	9579061	9627704	41
20	9416665	9473967	9528383	9579896	9628490	40
21	9417644	9474898	9529264	9580730	9639275	39
22	9418622	9475828	9530146	9581563	9630059	38
23	9419599	9476757	9531027	9582395	9630843	37
24	9420575	9477685	9531907	9584226	9631626	36
25	9421559	9478612	9532786	9584057	9632408	35
26	9422525	9479539	9533664	9584887	9633189	34
27	9423499	9480465	9534541	9585716	9633969	33
28	9424472	9481390	9535418	9586544	9634788	32
29	9425444	9482314	9536294	9587371	9635527	31
30	9426414	9483237	9537169	9588167	9636305	30
	19	18	17	16	15	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	70	71	72	73	74	
30	9426414	9483237	9537169	9588197	9636305	30
31	9427385	9484160	9538043	9589023	9637082	29
32	9428356	9485082	9538917	9589848	9637858	28
33	9429325	9486003	9539790	9590672	9638633	27
34	9430293	9486923	9540662	9591495	9639508	26
35	9431260	9487842	9541533	9592318	9640182	25
36	9432227	9488761	9542403	9593140	9640955	24
37	9433193	9489679	9543272	9593961	9641727	23
38	9434158	9490596	9544141	9594781	9642498	22
39	9435122	9491512	9545009	9595600	9643268	21
40	9436085	9492427	9545876	9596419	9644038	20
41	9437048	9493341	9546742	9597237	9644807	19
42	9438010	9494255	9547607	9597054	9645575	18
43	9438971	9495168	9548472	9598870	9646342	17
44	9439931	9496080	9549336	9599685	9647108	16
45	9440890	9496991	9550199	9600499	9647373	15
46	9441849	9497902	9551061	9601313	9648638	14
47	9442807	9498812	9551922	9602126	9649402	13
48	9443794	9499721	9552783	9602938	9650165	12
49	9444720	9500629	9553643	9603749	9650927	11
50	9445676	9501536	9554502	9604559	9651689	10
51	9446632	9502443	9555360	9605368	9652450	9
52	9447585	9503349	9556217	9606177	9653210	8
53	9448538	9504254	9557074	9606985	9653969	7
54	9449490	9505158	9557730	9607762	9654727	6
55	9450441	9506061	9558785	9608598	9655484	5
56	9451392	9506963	9559639	9609403	9656240	4
57	9452342	9507865	9560492	9610208	9656996	3
58	9453291	9500766	9561345	9611012	9657751	2
59	9454239	9500666	9562197	9611815	9658505	1
60	9455186	9510565	9562048	9612617	9659258	0
	19	18	17	16	15	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	75	76	77	78	79	
0	9659258	9702957	9743700	9781476	9816272	60
1	9660011	9703660	9744355	9782080	9816827	59
2	9660763	9704363	9745008	9782684	9817381	58
3	9661514	9705065	9745660	9783287	9817934	57
4	9662264	9705766	9746312	9783889	9818486	56
5	9663013	9706466	9746963	9784490	9819037	55
6	9663761	9707165	9747613	9785090	9819587	54
7	9664508	9707863	9748262	9785689	9820137	53
8	9665255	9708561	9748910	9786288	9820686	52
9	9666001	9709258	9749557	9786886	9821234	51
10	9666746	9709954	9750203	9787483	9821781	50
11	9667490	9710649	9750849	9788079	9822327	49
12	9668233	9711343	9751494	9788674	9822872	48
13	9668979	9712036	9752138	9789268	9823417	47
14	9669718	9712729	9752781	9789862	9823961	46
15	9670459	9713421	9753424	9790455	9824504	45
16	9671199	9714112	9754065	9791047	9825046	44
17	9671938	9714802	9754706	9791638	9825587	43
18	9672677	9715491	9755346	9792228	9826128	42
19	9673415	9716180	9755985	9792818	9826668	41
20	9674152	9716868	9756623	9793407	9827207	40
21	9674888	9717555	9757260	9793995	9827745	39
22	9675623	9718241	9757897	9794582	9828282	38
23	9676357	9718926	9758533	9795168	9828818	37
24	9677091	9719610	9759168	9795753	9829354	36
25	9677824	9720294	9759802	9796337	9829889	35
26	9678556	9720977	9760433	9796921	9830423	34
27	9679287	9721659	9761067	9797504	9830956	33
28	9680017	9722340	9761699	9798086	9831488	32
29	9680747	9723020	9762330	9798667	9832019	31
30	9681478	9723699	9762960	9799247	9832549	30
	14	13	12	11	10	

The minutes of deg. of the Quadrant for right Sines of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	75	76	77	78	79	
30	9681376	9723699	9762960	9799247	9832549	30
31	9682205	9724378	9763589	9799827	9833079	29
32	9682931	9725056	9764217	9800406	9833608	28
33	9683657	9725733	9764844	9800984	9834136	27
34	9684383	9726409	9765470	9801561	9834663	26
35	9685108	9727085	9766098	9802137	9835189	25
36	9685832	9727760	9766723	9802712	9835714	24
37	9686555	9728434	9767347	9803287	9836239	23
38	9687277	9729107	9767970	9803861	9836763	22
39	9687998	9729779	9768593	9804434	9837286	21
40	9688719	9730450	9769215	9805006	9837808	20
41	9680439	9731120	9769836	9805677	9838429	19
42	9690158	9731789	9770446	9806147	9838850	18
43	9690876	9732458	9771075	9806716	9839370	17
44	9691593	9733126	9771693	9807285	9839889	16
45	9692309	9773793	9772311	9807853	9840407	15
46	9693025	9734459	9772928	9808420	9840924	14
47	9693740	9735124	9773544	9808986	9841440	13
48	9694454	9735989	9774159	9809551	9841956	12
49	9695167	9736453	9774773	9810119	9842471	11
50	9695879	9737116	9775387	9810680	9842985	10
51	9696590	9737778	9776000	9811243	9843498	9
52	9697301	9738439	9776612	9811805	9844010	8
53	9698011	9739099	9777223	9812366	9844521	7
54	9698720	9739759	9777833	9812926	9845032	6
55	9699428	9740418	9778442	9813486	9845542	5
56	9700135	9741076	9779050	9814045	9846051	4
57	9700842	9731733	9779658	9814603	9846559	3
58	9701558	9742389	9780265	9815160	9847066	2
59	9702253	9743045	9780871	9815716	9847572	1
60	9762957	9743700	9781476	9816271	9848078	0
	14	13	12	11	10	

The minutes of deg. of the Quadrant for right Sines of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	80	81	82	83	84	
0	9848078	9876883	9902681	9925461	9945219	60
1	9848583	9877338	9903085	9925816	9945523	59
2	9849087	9877792	9903489	9926169	9945826	58
3	9849590	9878245	9903892	9926521	9946128	57
4	9850093	9878697	9904294	9926873	9946429	56
5	9850595	9879148	9904695	9928224	9946729	55
6	9851096	9879598	9905095	9927574	9947028	54
7	9851595	9880048	9905494	9927923	9947327	53
8	9852092	9880497	9905893	9928271	9947625	52
9	9853590	9880945	9906291	9928618	9947922	51
10	9853087	9881392	9906688	9928965	9948218	50
11	9853583	9881838	9907084	9929311	9948513	49
12	9854079	9882283	9907479	9929656	9948807	48
13	9854574	9882728	9907873	9930000	9949100	47
14	9855068	9883172	9908266	9930343	9949393	46
15	9855561	9883615	9908659	9930685	9949685	45
16	9856053	9884057	9909051	9931026	9949976	44
17	9856544	9884498	9909442	9931367	9950266	43
18	9857035	9884938	9909832	9931707	9950555	42
19	9857525	9885378	9910221	9932046	9950844	41
20	9858014	9885817	9910610	9932384	9951132	40
21	9858502	9886255	9910998	9932721	9951419	39
22	9858989	9886692	9911385	9933057	9951705	38
23	9859475	9887128	9911771	9933392	9951990	37
24	9859961	9887564	9912156	9933728	9952274	36
25	9860446	9887999	9912540	9934062	9952557	35
26	9860930	9888433	9912923	9934395	9952840	34
27	9861413	9888866	9913306	9935727	9953122	33
28	9861895	9889298	9913688	9935058	9953403	32
29	9862376	9889729	9914069	9935389	9953683	31
30	9862856	9890159	9914449	9935719	9953962	30
	9	8	7	6	5	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	80	81	82	83	84	
30	9862856	9890159	9914440	9935719	9953962	30
31	9863336	9890588	9914828	9936048	9954240	29
32	9863815	9891017	9915206	9936376	9954518	28
33	9864293	9891445	9915583	9936703	9954795	27
34	9864770	9891872	9915961	9937029	9955071	26
35	9865246	9892298	9916337	9937255	9955346	25
36	9865722	9892723	9916712	9937680	9955620	24
37	9866179	9893147	9917086	9938004	9955893	23
38	9866671	9893571	9917459	9938327	9956165	22
39	9867144	9893994	9917832	9938649	9956437	21
40	9867616	9894416	9918204	9938970	9956708	20
41	9868087	9894837	9918575	9939290	9956978	19
42	6868557	9895257	9918945	9939609	9957247	18
43	9869027	9895677	9919314	9939928	9957515	17
44	9869496	9896096	9919682	9940246	9957782	16
45	9869964	9896514	9920049	9940563	6958049	15
46	9870431	9896931	9920416	9940879	9958315	14
47	9870897	9897347	9920782	9941194	9958580	13
48	9871362	9897762	9922147	9941509	9958844	12
49	9871827	9898177	9921511	9941823	9959107	11
50	9872291	9898591	9921874	9942136	9959370	10
51	9872754	9890004	9922236	9942448	9959632	9
52	9873216	9899416	9922598	9942759	9959893	8
53	9873677	9898827	9922959	9943069	9960153	7
54	9874137	9900237	9923319	9943379	9960412	6
55	9874597	9900646	9923678	9943688	9960670	5
56	9875056	9901055	9924036	9943996	9960927	4
57	9875514	9901463	9924393	9944303	9961183	3
58	9875971	9901870	9924750	9944610	9961438	2
59	9876427	9902276	9925106	9944915	9961593	1
60	9876883	9902681	9925461	9949192	9961947	0
	9	8	7	6	5	

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for right Sines

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	85	86	87	88	89	
0	9961947	9975640	9986295	9993908	9998477	60
1	9962200	9975843	9986447	9994009	9998527	59
2	996245	9976045	9986598	9994109	9998576	58
3	9962703	9976240	9986748	9994208	9998625	57
4	9962954	9976446	9986897	9994307	9998673	56
5	9963204	9976645	9987045	9994405	9998720	55
6	9963453	9976843	9987193	9994502	9998766	54
7	9963701	9977040	9987340	9994598	9998811	53
8	9963948	9977237	9987486	9994693	9998855	52
9	9964194	9977434	9987631	9994787	9998899	51
10	9964440	9977628	9987775	9994881	9998942	50
11	9964685	9977822	9987918	9994974	9998984	49
12	9964929	9978015	9988061	9995066	9999025	48
13	9965172	9978207	9988203	9995157	9999065	47
14	9965414	9978398	9988344	9995247	9999104	46
15	9965655	9978589	9988484	9995336	9999143	45
16	9966895	9978779	9988623	9995424	9999182	44
17	9966135	9978968	9988761	9995512	9999218	43
18	9966374	9979156	9988899	9995599	9999254	42
19	9966612	9979343	9989036	9995685	9999289	41
20	9966849	9979530	9989172	9995770	9999323	40
21	9967085	9979716	9989307	9995854	9999356	39
22	9967320	9979901	9989441	9995937	9999389	38
23	9967555	9980083	9989574	9996019	9999421	37
24	9967789	9980268	9989706	9996101	9999452	36
25	9968022	9980450	9989837	9996182	9999482	35
26	9968254	9980631	9989968	9996262	9999511	34
27	9968485	9980811	9990098	9996341	9999539	33
28	9968715	9980992	9990227	9996419	9999566	32
29	9968944	9981169	9990355	9996496	9999593	31
30	9969173	9981348	9990482	9996573	9999619	30
	4	3	2	1	0	

The degrees of the Quadrant for right Sines

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for right Sines of the arches of the ſame Quadrant.

	85	86	87	88	89	
30	9969173	9981348	9990482	9996573	9999619	30
31	9969401	9981325	9990608	9996649	9999644	29
32	9969628	9981701	9990724	9996734	9999668	28
33	9969854	9981877	9990859	9996798	9999691	27
34	9970079	9982052	9990983	9996871	9999713	26
35	9970304	9982226	9991106	9996943	9999735	25
36	9970528	9982399	9991228	9997014	9999756	24
37	9970751	9982571	9991349	9997085	9999776	23
38	9970973	9982742	9991470	9997155	9999795	22
39	9971194	9982912	9991590	9997224	9999813	21
40	9971414	9983082	9991709	9997292	9999830	20
41	9971633	9983251	9991827	9997359	9999846	19
42	9971851	9983419	9991944	9997425	9999862	18
43	9972069	9983586	9992060	9997491	9999877	17
44	9972286	9983752	9992175	9997556	9999891	16
45	9972502	9983917	9992290	9997620	9999904	15
46	9972717	9984081	9992404	9997683	9999916	14
47	9972931	9984245	9992517	9997745	9999927	13
48	9973145	9984408	9992629	9997806	9999938	12
49	9973358	9984570	9992740	9997867	9999948	11
50	9973570	9984731	9992850	9997927	9999957	10
51	9973781	9984891	9992960	9997986	9999965	9
52	9973991	9985050	9993069	9998044	9999972	8
53	9974200	9985209	9993177	9998101	9999978	7
54	9974408	9985367	9993284	9998157	9999984	6
55	9974615	9985524	9993390	9998212	9999989	5
56	9974822	9985680	9993495	9998267	9999993	4
57	9975028	9985835	9993599	9998321	9999996	3
58	9975233	9985989	9993703	9998374	9999998	2
59	9975437	9986143	9993806	9998426	9999999	1
60	9975640	9986295	9993908	9998477	1000000	0
	4	3	2	1	0	

of the complements of the arches of the ſame Quadrant.

The minutes of deg. of the Quadrant for right Sines of the cōplements of the arches of the ſame Quadrant.

THE
TABLE OF TANGENTS OTHERWISE CALLED THE FRVITFVLL *TABLE.*

The degrees of the Quadrant for the Tangents,

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	0	1	2	3	4	
0	0000	[illegible]	[illegible]	[illegible]	[illegible]	60
1	2909	177459	352122	526995	702193	59
2	5818	180369	355033	529911	705116	58
3	8727	183279	357945	532828	708039	57
4	11636	186189	360858	535745	710962	56
5	14544	189100	363770	538663	713886	55
6	17452	192010	366683	541580	716809	54
7	20361	194920	369596	544498	719733	53
8	23270	197830	372508	547415	722657	52
9	26179	200740	375421	550333	725580	51
10	29088	203650	378334	553251	728504	50
11	31996	206561	381247	556169	731428	49
12	34905	209471	384160	559087	734353	48
13	37814	212381	387073	562005	737277	47
14	40723	215291	389987	564923	740202	46
15	43632	218201	392900	567841	743127	45
16	46541	221111	395814	570759	746052	44
17	46450	224022	398727	573678	748978	43
18	52359	226932	401641	576596	751903	42
19	55268	229842	404554	579514	754829	41
20	58177	232752	407468	582433	757754	40
21	[illegible]	[illegible]	[illegible]	[illegible]	760680	39
22	[illegible]	[illegible]	[illegible]	588270	763606	38
23	66904	241485	416209	591189	767632	37
24	69813	244395	419123	594108	769459	36
25	72722	247306	422037	597028	772385	35
26	75631	250217	424951	599947	775311	34
27	78540	253128	427866	602866	778238	33
28	81450	256038	430780	605786	781164	32
29	84359	258949	433694	608705	784091	31
30	87268	261859	436609	611625	787017	30
	89	88	87	86	85	

The minutes of deg. of the Quadrant for Tangents of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents.

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for Tangents of the arches of the ſame Quadrant.

	0	1	2	3	4	
30	87268	261859	436609	611625	787017	30
31	90177	264770	439524	614544	789944	29
32	93086	267681	442438	617464	792871	28
33	95995	270592	445353	620384	795799	27
34	98904	273503	448267	623304	798726	26
35	101813	276414	451182	626225	801653	25
36	104723	279325	454097	629145	804581	24
37	107632	282237	457012	632061	807509	23
38	110541	285848	459996	634986	810437	22
39	113450	288059	462842	637907	813365	21
40	116360	290970	465757	640828	816293	20
41	119269	293882	468672	643749	819221	19
42	122178	296794	471588	646671	822150	18
43	125088	299705	474503	649592	825079	17
44	127997	302617	477419	652514	828008	16
45	130906	305528	480335	655435	830937	15
46	133816	308439	483251	658357	833866	14
47	136725	311351	486166	661278	836795	13
48	139635	314263	489082	664200	839724	12
49	142544	317174	491997	667121	842653	11
50	145454	320085	494913	670043	845583	10
51	148363	322997	497829	672905	848513	9
52	151273	325909	500745	675888	851443	8
53	154182	328821	503662	678810	854374	7
54	157092	331733	506578	681733	857304	6
55	160001	334645	509495	684656	860234	5
56	162911	337558	512411	687578	863164	4
57	165820	340470	515328	690501	866095	3
58	168730	343382	518244	693433	869025	2
59	171640	346295	521161	696346	871956	1
60	174550	349207	524078	699269	874886	0
	89	88	87	86	85	

The minutes of deg. of the Quadrant for Tangents of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	5	6	7	8	9	
0	874886	1051042	1227845	1405408	1583844	60
1	877817	1053983	1230798	1408374	1586826	59
2	880748	1056924	1233751	1411341	1589808	58
3	883680	1059866	1236704	1410308	1592791	57
4	886611	1062808	1229658	2417275	1595774	56
5	889543	1065750	1242612	1420242	1598757	55
6	892475	1068692	1245566	1412210	1601746	54
7	895407	1071634	1248520	1426178	1604723	53
8	898339	1074576	1251474	1429146	1607707	52
9	901271	1077518	1254428	1432115	1610691	51
10	904204	1080461	1267383	1435084	1613675	50
11	907137	1083404	1260338	1438053	1616660	49
12	910070	1086347	1263293	1441022	1619645	48
13	913003	1089291	1266249	1443952	1622630	47
14	915936	1092234	1269205	1446961	1625615	46
15	918870	1095178	1272161	1449991	1628601	45
16	921804	1098122	1275117	1453701	1631587	44
17	924738	1101066	1278073	1455871	1634573	43
18	927671	1104010	1281029	1458842	1637560	42
19	930605	1106954	1283986	1461813	1640547	41
20	933539	1109899	1286942	1464784	1643534	40
21	936473	1112844	1289900	1467754	1646522	39
22	939407	1115789	1292857	1470727	1649510	38
23	942342	1118734	1295815	1473699	1652499	37
24	945277	1121680	1298773	1476671	1655488	36
25	948212	1124625	1301731	1479644	1658477	35
26	951147	1127571	1304689	1482617	1661466	34
27	954083	1130517	1307648	1485590	1664456	33
28	957019	1133463	1210607	1488563	1667446	32
29	959954	1136409	1313566	1439536	1670436	31
30	962890	1139355	1316525	1494510	1673426	30
	84	83	82	81	80	

The minutes of deg. of the Quadrant for Tangents of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents.

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for Tangents of the arches of the ſame Quadrant.

	5	6	7	8	9	
30	962890	1139355	1316525	1494510	1673426	30
31	965826	1142302	1310485	1497484	1676417	29
32	968763	1145249	1322445	1500458	1679408	28
33	971699	1148196	1325405	1503433	1682399	27
34	974636	1151144	1328365	1506408	1685390	26
35	977573	1154091	1331325	1509383	1688382	25
36	980509	1157030	1334285	1522358	1691374	24
37	983446	1159988	1337246	1515334	1694366	23
38	986383	1162936	1340207	1518310	1697358	22
39	989320	1165884	1343168	1521286	1700351	21
40	992257	1198832	1346129	1524262	1703344	20
41	995195	1171781	1349091	1527239	1706337	19
42	998133	1174730	1352053	1530216	1709331	18
43	1001072	1177679	1355015	1533193	1712325	17
44	1004010	1180628	1357977	1536170	1715319	16
45	1006949	1183577	1360940	1539148	1718313	15
46	1009887	1186527	1363903	1542126	1721308	14
47	1012825	1189477	1366866	1545104	1724304	13
48	1015763	1192427	1369830	1548082	1727300	12
49	1018702	1195377	1372793	1551061	1730269	11
50	1021641	1198328	1275757	1554040	1733292	10
51	1024580	1201279	1378721	1557019	1736288	9
52	1027519	1204220	1381686	1559999	1739284	8
53	1030459	1207181	1384650	1562979	1742281	7
54	1033399	1210132	1387615	1565959	1745278	6
55	1036339	1213084	1390580	1568939	1748275	5
56	1039279	1216026	1393545	1571920	1751273	4
57	1042219	1218988	1396510	1574901	1774271	3
58	1045160	1221940	1309476	1577882	1577270	2
59	1048101	1224892	1402442	1580863	1760260	1
60	1051042	1227845	1405408	1583844	1763268	0
	84	83	82	81	80	

The minutes of deg. of the Quadrant for Tangents of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for Tangents.

The minutes of the degrees of the Quadrant for Tangents of the arches of the ſame Quadrant.

	16	11	12	13	14	
0	1763268	1943803	2125565	2308682	2493280	60
1	1766268	1946822	2125565	2311746	2496370	59
2	1769268	1949841	2131646	2314810	2499461	58
3	1772268	1952[illegible]61	2134687	2317875	2502552	57
4	1775269	1955881	2137729	2320940	2505643	56
5	1778270	1958901	2140771	2324006	2508735	55
6	1781271	1961922	2143814	2327072	2511827	54
7	1784271	1964943	2146857	2330139	2514920	53
8	1787274	1967964	2149009	2333206	2518013	52
9	1790276	1970985	2152944	2336273	2521106	51
10	1793278	1974007	2155988	2336341	2524200	50
11	1796281	1977029	2159032	2342409	2527294	49
12	1799284	1980052	2162077	2345478	2530389	48
13	1802287	1983075	2165122	2348547	2533484	47
14	1805291	1686098	2168167	2351616	2536580	46
15	1808295	1989122	2171213	2354686	2539676	45
16	1811299	1992146	2174259	2357757	2542773	44
17	1814303	1995171	2177306	2360828	2545870	43
18	1817308	1998196	2180352	2363899	2548968	42
19	1820313	2001221	2183400	2366971	2552066	41
20	1800318	2004247	2186448	2370043	2555165	40
21	1826324	2007273	2189496	2373116	2558264	39
22	1829329	2010299	2192544	2376189	2561364	38
23	1832335	2013326	2195593	2379263	2564464	37
24	1835342	2016353	2198643	2382337	2567564	36
25	1838349	2019380	2201692	2385411	2570665	35
26	1841357	2028408	2204742	2388486	2573766	34
27	1844365	2025436	2207792	2391561	2576868	33
28	1847373	2028464	2210843	2394636	2579970	32
29	1850382	2031494	2213894	2397712	2583073	31
30	1853391	2034522	2216946	2400788	2586176	30
	79	78	77	76	75	

The minutes of deg. of the Quadrant for Tangents of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for Tangents.

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for Tangents of the arches of the ſame Quadrant.

	10	11	12	13	14	
30	1853391	2034522	2216946	2400788	2586176	30
31	1856400	2037552	2219998	2403865	2589280	29
32	1859409	2040582	2223051	2406942	2592384	28
33	1802419	2043612	2226104	2410020	2595489	27
34	1865429	2046643	2229157	2413098	2598594	26
35	1868439	2049674	2232211	2416176	2601700	25
36	1871449	2052705	2235265	2419255	2604806	24
37	1874460	2055737	2238319	2422334	2607912	23
38	1877471	2058769	2241374	2425414	2611019	22
39	1880482	2061801	2244429	2428494	2614126	21
40	1883494	2064834	2247485	2431574	2617234	20
41	1886506	2067867	2250541	2434655	2620342	19
42	1889518	2070900	2253597	2437736	2623451	18
43	1892531	2073934	2256654	2440818	2626560	17
44	1895544	2076968	2259711	2443900	2629670	16
45	1898558	2080002	2262766	2446983	2632780	15
46	1901572	2082337	2265827	2450066	2635891	14
47	1604586	2086073	2268885	2453150	2639002	13
48	1907601	2089109	2271944	2456234	2642114	12
49	1910616	2092145	2275003	2459319	2645226	11
50	1913632	2095182	2278063	2462404	2648339	10
51	1916648	2098219	2281123	2465490	2651452	9
52	1919664	2101256	2284183	2468576	2654566	8
53	1922680	2104293	2287244	2471662	2657680	7
54	1925697	2107331	2290365	2474749	2660795	6
55	1928714	2110369	2293367	2477836	2663910	5
56	1931731	2113407	2296429	2480924	2667026	4
57	193474[illegible]	2116446	2299492	2484012	2670142	3
58	1937767	2119485	2302555	2487101	2673258	2
59	1940785	2122525	2305618	2490191	2676375	1
60	1942803	2125565	2308682	2493280	2679491	0
	79	78	77	76	75	

The minutes of deg. of the Quadrant for Tangents of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for Tangents.

The minutes of the degrees of the Quadrant for Tangents of the arches of the ſame Quadrant.

	15	16	17	18	19	
0	2679492	2867453	3057307	3249197	3443276	60
1	2682610	2870601	3060487	3252413	3446530	59
2	2685728	2873749	3063669	3255630	3449785	58
3	2688847	2876898	3066851	3258848	3453040	57
4	2691966	2880048	3070034	3262066	3456296	56
5	2695086	2883198	3073218	3265285	3459553	55
6	2698206	2886249	3076402	3268504	3462810	54
7	2701327	2889501	3079587	3271724	3466068	53
8	2704448	2892653	3082772	3274944	3469326	52
9	2707570	2895806	3085958	3278165	3472585	51
10	2710692	2898960	3089144	3281387	3475845	50
11	2713816	2902114	3092331	3284609	3479105	49
12	2716940	2905268	3095518	3287832	3472366	48
13	2720064	2908423	3098706	3291055	3485628	47
14	2723189	2911578	3101895	3294280	3488891	46
15	2726314	2914734	3105084	3297505	3492154	45
16	2729439	2917890	3108274	3300731	3495418	44
17	2732565	2921047	3111464	3303957	3498683	43
18	2735691	2924204	3114655	3307184	3501949	42
19	2738818	2927362	3117846	3310411	3505215	41
20	2741945	2930520	3121038	3313639	3508482	40
21	2745073	2933679	3124230	3316868	3511749	39
22	2748201	2936839	3127423	3320097	3515017	38
23	2751330	2939999	3130817	3323327	3518286	37
24	2754459	2943160	3133811	3326558	3521555	36
25	2757589	2946321	3137006	3329789	3524825	35
26	2760719	2949488	3140201	3333020	3528096	34
27	2763850	2952645	3143397	3336252	3531368	33
28	2766981	2955808	3146594	3339485	3534640	32
29	2770113	2958972	3149791	3342719	3537913	31
30	2773245	2962135	3152989	3345953	3541186	30
	74	73	72	71	70	

The minutes of deg. of the Quadrant for Tangents of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for Tangents.

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for Tangents of the arches of the ſame Quadrant.

	15	16	17	18	19	
30	2773245	2962135	3152989	3345953	3541186	30
31	2776378	2965299	3156187	3349188	3544462	29
32	2779511	2968464	3159386	3352423	3547735	28
33	2782645	2971629	3162585	3355659	3551010	27
34	2785779	2974795	3165785	3358896	3554286	26
35	2788914	2977922	3168986	3362133	3557563	25
36	2792050	2981129	3172167	3365371	3560840	24
37	2795186	2984297	3175389	3308610	3564118	23
38	2798323	2987465	3178591	3371850	3567397	22
39	2801460	2990634	3181794	3375090	3570676	21
40	2804597	2993804	3184998	3378331	3573956	20
41	2807735	2996973	3188202	3381572	3577237	19
42	2810872	3000143	3191407	3384814	3580519	18
43	2814012	3003914	3194618	3388057	3583801	17
44	2817151	3006486	3197819	3391400	3587084	16
45	2820291	3009658	3201026	3394544	3590367	15
46	2823432	3012831	3204235	3397788	3593651	14
47	2826573	3016004	3207441	3401033	3596936	13
48	2829714	3019178	3210649	3404279	3600221	12
49	2832856	3022353	3213858	3407525	3603507	11
50	2835999	3025528	3217067	3410772	3606794	10
51	2839142	3028703	3220277	3414020	3610082	9
52	2842286	3031879	3223488	3417268	3613370	8
53	2845430	3035055	3226699	3426517	3616659	7
54	2848575	3038232	3229911	3423766	3619949	6
55	2851720	3041410	3233124	3427016	3623239	5
56	2854866	3044588	3236337	3420267	3626530	4
57	2858012	3047767	3239551	3433518	3629822	3
58	2861159	3050946	3242766	3436770	3633115	2
59	2864306	3054126	3245981	3440027	3636408	1
60	2867453	3057307	3249197	3443276	3639702	0
	74	73	72	71	70	

The minutes of deg. of the Quadrant for Tangents of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	20	21	22	23	24	
0	3639702	3838640	4040261	4244748	4452286	60
1	3642997	3841978	4043646	4248182	4455772	59
2	3646293	3845318	4047031	4251617	4459250	58
3	3649589	3848659	4056140	4255052	4462747	57
4	3652886	3851995	4053802	4258488	4466236	56
5	3656183	3855336	4057189	4261925	4469726	55
6	3659481	3858678	4060577	4265363	4473216	54
7	3662780	3862020	4063966	4268801	4476707	53
8	3666079	3865363	4067356	4272240	4480199	52
9	3669379	9868707	4070747	4275680	4483692	51
10	3672680	3872052	4074139	4279121	4487186	50
11	3675982	3875397	4077531	4282563	4490681	49
12	3679284	3878743	4080924	4286005	4494177	48
13	3682587	3882090	4084318	4289450	4497674	47
14	3685801	9885438	4087713	4292894	4501172	46
15	3689195	3888787	4091109	4296339	4504671	45
16	3692500	3892136	4094506	4299785	4508171	44
17	3695806	3895486	4097903	4303232	4511672	43
18	3699113	3898837	4101301	4306681	4515173	42
19	3702420	3902188	4104699	4310129	4518675	41
20	8705728	3905540	4108097	4313579	4522178	40
21	3709037	3908893	4111497	4317029	4525682	39
22	3712347	3912247	4114898	4320481	4529187	38
23	3715657	3915601	4118300	4323932	4532693	37
24	3718968	3918956	4121702	4327386	4536200	36
25	3722279	3922312	4125107	4330840	4539708	35
26	3725591	3925669	4128511	4334295	4543217	34
27	3728904	3929027	4131916	4337751	4546727	33
28	3732218	3932385	4135322	4341203	4550238	32
29	3735533	3935744	4138728	4344665	4553750	31
30	3738848	3939104	4142135	4348124	4557264	30
	69	68	67	66	65	

The minutes of deg. of the Quadrant for the Tangents of the coplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	20	21	22	23	24	
30	3738848	3939104	4142135	4348124	4557264	30
31	3742164	3942465	4145544	4351583	4560778	29
32	3745480	3945826	4148953	4355043	4564292	28
33	3748797	3949188	4152363	4358504	4567809	27
34	3752115	3952551	4155773	4361966	4571326	26
35	3755434	3955915	4159184	4365429	4574843	25
36	3758753	3959280	4162596	4368893	4578361	24
37	3762073	3962646	4166009	4372357	4581880	23
38	3765394	3966012	4169422	4375822	4585400	22
39	3768716	3969379	4172838	4379288	4588921	21
40	3772038	3932746	4176255	4382755	4592443	20
41	3775361	3976114	4179672	4386223	4595966	19
42	3778685	3979483	4183090	4389691	4599490	18
43	3782010	3982853	4186509	4393162	4603015	17
44	3785335	3986224	4189928	4396633	5606541	16
45	3788661	3989566	4193348	4400105	4610068	15
46	3791988	3992969	4196769	4403578	4613596	14
47	3795315	3996342	4200191	4407051	4617125	13
48	3798643	3999716	4203610	4410525	4610654	12
49	3801972	4003090	4207036	4414000	4624184	11
50	3805302	4006465	4210460	4417476	4627715	10
51	3808632	4009841	4213885	4420953	4631247	9
52	3811963	4013217	4217311	4424431	4634780	8
53	3815295	4016594	4226738	4427910	4638314	7
54	3818628	4019972	4224165	4431390	4641849	6
55	3821961	4023351	4227593	4434871	4645385	5
56	3825295	4026731	4231022	4438352	4648922	4
57	3828630	4030112	4234452	4441834	4652460	3
58	3831966	4033494	4237882	4445317	4655999	2
59	3835303	4036877	4241315	4448801	4659540	1
60	3838640	4040261	4344748	4452286	4662081	0
	69	68	67	66	65	

The minuts of deg. of the Quadrant for the Tangents of the coplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for Tangents

The minutes of the degrees of the Quadrant for Tangents of the arches of the ſame Quadrant.

	25	26	27	28	29	
0	4663081	4877328	5095254	5317094	5543000	60
1	4666623	4880930	5098919	5320026	5546890	59
2	4670166	4884533	5102585	5324559	5550697	58
3	4673710	4888137	5106252	5328293	5554503	57
4	4677255	4891742	5109920	5332028	5558310	56
5	4680801	4895347	5113589	5335765	5502118	55
6	4684348	4898953	5117259	5339003	5565927	54
7	4687896	4902560	5120930	5342342	5509738	53
8	4691444	4906168	5124602	5346982	5573550	52
9	4694993	4809777	5128275	5350723	5577363	51
10	4698543	4913387	5131949	5354465	5581177	50
11	4702094	4910998	5135625	5358209	5584993	49
12	4705646	4920610	5139301	5361954	5588810	48
13	4769199	4924223	5142980	5365700	5592027	47
14	4712753	4927838	5146659	5369447	5596447	46
15	4716308	4931454	5150339	5373195	5600268	45
16	4719864	4935071	5154020	5376944	5604090	44
17	4723422	4938680	5157702	5380694	5607913	43
18	4726981	4942308	5161385	5384445	5611737	42
19	4730541	4945928	0165069	5388198	5615562	41
20	4734102	4949549	5168755	5391952	5619388	40
21	4737664	4953171	5172442	5395707	5623216	39
22	4741227	4956794	5176130	5399463	5627045	38
23	4744790	4960418	5179819	5403221	5630875	37
24	4748354	4964043	5183509	5406980	5634707	36
25	4752919	4967669	5187200	5410740	5638540	35
26	4755485	4971296	5190892	5414501	5642374	34
27	4759052	4974924	5194585	5418263	5646210	33
28	4762620	4978853	5198279	5422026	5650047	32
29	4766189	4982184	5201974	5425791	5653885	31
30	4869759	4985816	5205670	5429557	5657725	30
	64	63	62	61	60	

The minutes of deg. of the Quadrant for Tangents of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for Tangents

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	25	26	27	28	29	
30	4769759	4985816	5205670	5429557	5657725	30
31	4773330	4989448	5209368	5433324	5661560	29
32	4776902	4993081	5213067	5437092	5665408	28
33	4780475	4996716	5216767	5440861	5669251	27
34	4784049	5000352	5220468	5444632	5673096	26
35	4787624	5003989	5224170	5448404	5676942	25
36	4791200	5007627	5227873	5452177	5680786	24
37	4794777	5012166	5231577	5455951	5684637	23
38	4798355	5014906	5235283	5459726	5688486	22
39	4801934	5018547	5238990	5463503	5692337	21
40	4805515	5022189	5242698	5467281	5696189	20
41	4809096	5025832	5246407	5471060	5700043	19
42	4812678	5029476	5250117	5474840	5703898	18
43	4816261	5033121	5253828	5478621	5707754	17
44	4819845	5036767	5257540	5482404	5711611	16
45	4823430	5040414	5201254	5486188	5715469	15
46	4827016	5044062	5264069	5489973	5719329	14
47	4830603	5047712	5268685	5493759	5723190	13
48	4834191	5051363	5272402	5497546	5727053	12
49	4837780	5055015	5276120	5501335	5730916	11
50	4841371	5058668	5279839	5505125	5734781	10
51	4844962	5062321	5283559	5508916	5738647	9
52	4848554	5065977	5287280	5512708	5742515	8
53	4852147	5069633	5291003	5516501	5746384	7
54	4855741	5073290	5294727	5520296	5750254	6
55	4859336	5076948	5298452	5524092	5754125	5
56	4862932	5080607	5302178	5527889	5757998	4
57	4866529	5084267	5305905	5531687	5701872	3
58	4870127	5087928	5309633	5535487	5765747	2
59	4873727	5091590	5313363	5539288	5769624	1
60	4877328	5095254	5317094	5543090	5773503	0
	64	63	62	61	60	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	30	31	32	33	34	
0	5773503	6008606	6248693	6494076	6745085	60
1	5777381	6012566	6252738	6498212	6749318	59
2	5781262	6016528	6256785	6502350	6753553	58
3	5785144	6020491	6260834	6506489	6757789	57
4	5789027	6024455	6264884	6510630	6762027	56
5	5792911	6028420	6268935	6514773	6766267	55
6	5796797	6032387	6272988	6518917	6770508	54
7	5800684	6036355	6277042	6523063	6774751	53
8	5804572	6040324	6281098	6527210	6778996	52
9	5801862	6044295	6285155	6531359	6783243	51
10	5812353	6048267	6289214	6535510	6787491	50
11	5816245	6052241	6293274	6539662	6791741	49
12	5820139	6056216	6297336	6543816	6795993	48
13	5824034	6060193	6301399	6547971	6800246	47
14	5827930	6064171	6305464	6552128	6804501	46
15	5831828	6068150	6309530	6556287	6808758	45
16	5835727	6072131	6313598	6560447	6813016	44
17	5839627	6076113	6317667	6564609	6817276	43
18	5843528	6080096	6321738	6568772	6821538	42
19	5847431	6084081	6325810	6572937	6825801	41
20	5851335	6088067	6329883	6577103	6830066	40
21	5855241	6092055	6333958	6581271	6834333	39
22	5859148	6096044	6338034	6585440	6838602	38
23	5863056	6100035	6342112	6589611	6842872	37
24	5866966	6104027	6346191	6593784	6847144	36
25	5870877	6108020	6350272	6597958	6851417	35
26	5874789	6112015	6354355	6602134	6855692	34
27	5878702	6116011	6358439	6606312	6859969	33
28	5882617	6120008	6362525	6610491	6864247	32
29	5886533	6124008	6366613	6614672	6868527	31
30	5890450	6128008	6370702	6618855	6872809	30
	59	58	57	56	55	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	30	31	32	33	34	
30	5890450	6128008	6370702	6618855	6872809	30
31	5894369	6132010	6374792	6623039	6877063	29
32	5898289	6136013	6378884	6627225	6881379	28
33	5902211	6140018	6382977	6631413	6885666	27
34	5906134	6144024	6387072	6635603	6889955	26
35	5910058	6148032	6391169	6639794	6894246	25
36	5913984	6152041	6395267	6643986	6898539	24
37	5917911	6156052	6399366	6648179	6902833	23
38	5921839	6160064	6403467	6652374	6907129	22
39	5925769	6164077	6407569	6656570	6911426	21
40	5929700	6168092	6411673	6660768	6915725	20
41	5933633	6172108	6415779	6664968	6920026	19
42	5937567	6176126	6419886	6669170	6924329	18
43	5941502	6180147	6423995	6673373	6928634	17
44	5945438	6184168	6428105	6677578	6922940	16
45	5949376	6188190	6432216	6681785	6937248	15
46	5953315	6192213	6436329	6685994	6941558	14
47	5957255	6196237	6440444	6690208	6945869	13
48	5961197	6200263	6444560	6694416	6950182	12
49	5965140	6204290	6448678	6698630	6954497	11
50	5969084	6208319	6452798	6702845	6958813	10
51	5973030	6212350	6456919	6707062	6963131	9
52	5976977	6216382	6461042	6711281	6967451	8
53	5980926	6220416	6465166	6715501	6971773	7
54	5984876	6224451	6469291	6719723	6976097	6
55	5988827	6228488	6473419	6723946	6980423	5
56	5992780	6232526	6477548	6728171	6984750	4
57	5996734	6236566	6481678	6732397	6989079	3
58	6000690	6240607	6485809	6736625	6992409	2
59	6004647	6244649	6489942	6740854	6987741	1
60	6008606	6248693	6494076	6745085	7002795	0
	59	58	57	56	55	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	35	36	37	38	39	
0	7002075	7265424	7535541	7812856	8097840	60
1	7006411	7269869	7540103	7817542	8102658	59
2	7010749	7274316	7544667	7822230	8107478	58
3	7015088	7278765	7549233	7826920	8112300	57
4	7019429	7283216	7553801	7831613	8117124	56
5	7023772	7287669	7558371	7836306	8121951	55
6	7028117	7292124	7562943	7841002	8126780	54
7	7032463	7206581	7567517	7845700	8131611	53
8	7036811	7301040	7572093	7850400	8136444	52
9	7041161	7305501	7576670	7855102	8141280	51
10	7045513	7309963	7581249	7859807	8146118	50
11	7049867	7314427	7585830	7864514	8150958	49
12	7054223	7318893	7590413	7869223	8155801	48
13	7058581	7323361	7594999	7873934	8160646	47
14	7062940	7327831	7599587	7878647	8165493	46
15	7067301	7332303	7604177	7883363	8170343	45
16	7071662	7336777	7608769	7888081	8175195	44
17	7076029	7341253	7613363	7892801	8180049	43
18	7080395	7345731	7617959	7897523	8184905	42
19	7083463	7350210	7622557	7902247	8189764	41
20	7089133	7354691	7627157	7906973	8194625	40
21	7093505	7359174	7631759	7911702	8199488	39
22	7097879	7363659	7636363	7916433	8204354	38
23	7102254	7368146	7640966	7921166	8209222	37
24	7106631	7372635	7645577	7925901	8214092	36
25	7111010	7377126	7650187	7930638	8218965	35
26	7115391	7381619	7654799	7935378	8223840	34
27	7119773	7386114	7659413	7940120	8228717	33
28	7124157	7390611	7664030	7944864	8233597	32
29	7128543	7395110	7668649	7949610	8238479	31
30	7132921	7399610	7673270	7954358	8243363	30
	54	53	52	51	50	

The degrees of the Quadrant for the Tangents

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	35	36	37	38	39	
30	7132931	7399610	7673270	7954358	8243363	30
31	7137321	7404112	7677893	7959109	8248250	29
32	7141713	7408616	7682518	7963862	8253139	28
33	7146106	7413122	7687145	7968617	8258031	27
34	7150501	7417630	7691774	7973374	8262925	26
35	7154898	7422140	7696405	7978133	8267821	25
36	7159297	7426652	7701038	7982895	8272720	24
37	7163698	7431167	7705673	7987659	8277621	23
38	7168100	7435684	7710310	7992425	8282524	22
39	7172504	7440203	7714949	7987193	8287429	21
40	7176910	7444724	7719590	8001963	8292337	20
41	7181318	7449246	7724233	8006736	8297247	19
42	7185728	7453770	7728878	8011511	8302160	18
43	7190140	7458296	7733525	8016288	8307075	17
44	7194554	7462824	7738175	8021067	8311992	16
45	7198970	7407354	7742827	8025849	8316912	15
46	7203387	7471886	7747481	8030633	8321834	14
47	7207800	7476420	7752137	8035419	8326759	13
48	7212227	7480956	7756795	8040207	8331686	12
49	7216650	7485494	7761455	8044997	8336615	11
50	7221075	7490033	7766117	8049700	8341547	10
51	7225502	7494574	7770781	8054585	8346481	9
52	7229931	7499117	7775447	8059382	8351418	8
53	7234362	7503663	7780116	8064181	8356357	7
54	7238794	7508211	7784787	8068983	8361398	6
55	7243228	7512761	7789460	8073787	8366242	5
56	7247664	7517313	7704135	8078593	8371188	4
57	7252102	7521867	7798812	8083402	8376130	3
58	7256541	7526423	7803491	8088212	8381087	2
59	7260982	7530981	7808173	8093025	8389040	1
60	7265424	7535541	7812856	8097840	8390006	0
	54	53	52	51	50	

of the complements of the arches of the ſame Quadrant.

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	40	41	42	43	44	
0	8390996	8692867	9004040	9325151	9656888	60
1	8395954	8697975	9009303	9330591	9662511	59
2	8400915	8703085	9014570	9336024	9668137	58
3	8405878	8708198	9019853	9341480	9673766	57
4	8410844	8713314	9025130	9346929	9679398	56
5	8415812	8718433	9030410	9352381	9685034	55
6	8420782	8723555	9035693	9357835	9690674	54
7	8425754	8728679	9040978	9363292	9696316	53
8	8430729	8733806	9046266	9368752	9701960	52
9	8435706	8738935	9051557	9374215	9707609	51
10	8440686	8744067	9056850	9379681	9713261	50
11	8445668	8749201	9062146	9385152	9718916	49
12	8450653	8754338	9067445	9390625	9724574	48
13	8455640	8759478	9072747	9396101	9730235	47
14	8460630	8764620	9078052	9401580	9735900	46
15	8465622	8769764	9083360	9407062	9741568	45
16	8470617	8774911	9088670	9412547	9747239	44
17	8475614	8780061	9093983	9418034	9752913	43
18	8480614	8785214	9000290	9423524	9758591	42
19	8485617	8790369	9104618	9429017	9764272	41
20	8400623	8795527	9109940	9434513	9769956	40
21	8495029	8800688	9115265	9440013	9775643	39
22	8500629	8805851	9120593	9445513	9781334	38
23	8505651	8811017	9125923	9451019	9787028	27
24	8510666	8816186	9131256	9456528	9792725	36
25	8515683	8821357	9136592	9462040	9798425	35
26	8520703	8826531	9141920	9467555	9804128	34
27	8525725	8831708	9147271	9473072	9809835	33
28	8530750	8836887	9152615	9478594	9815545	32
29	8535777	8842069	9157962	9484118	9821258	31
30	8540806	8847252	9162212	9489645	9826974	30
	49	48	47	46	45	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	40	41	42	43	44	
30	8540806	8847252	9163312	9489645	9826974	30
31	8545838	8852440	9168665	9495175	9832694	29
32	8550872	8857630	9174021	9500708	9838417	28
33	8555909	8862822	9179380	9506244	9844143	27
34	8560949	8868017	9184741	9511782	9849872	26
35	8565991	8873215	9190105	9517325	9855005	25
36	8571036	8878415	9195472	9522870	9861341	24
37	8576083	8883618	9200842	9528419	9867080	23
38	8581133	8888824	9206215	9523971	9872823	22
39	8586185	8894033	9211590	9539526	9878568	21
40	8581239	8899244	9216968	9545084	9884317	20
41	8596296	8904458	9222349	9550645	9890070	19
42	8601355	8909675	9227733	9556209	9895836	18
43	8606417	8914894	9233120	9561776	9901585	17
44	8611482	8920116	9238510	9567346	9907347	16
45	8616549	8925341	9243903	9572919	9913113	15
46	8621619	8930568	9249299	9578495	9918882	14
47	8626692	8935798	9254698	9584074	9924654	13
48	8631767	8941031	9260100	9589656	9930430	12
49	8636845	8946267	7265505	9595241	9936209	11
50	8641926	8951506	9270913	9600830	9941991	10
51	8647009	8956747	9276324	9606422	9947777	9
52	8652095	8961991	9281728	9612017	9953560	8
53	8657183	8967238	9287155	9617615	9959359	7
54	8662273	8972487	9292574	9623216	9965155	6
55	8667366	8977739	9297996	9628820	9970954	5
56	8672461	8982994	9303421	9634427	9976750	4
57	8677559	8988252	9308849	9640037	9982562	3
58	8682659	8993512	9214280	9645651	9988271	2
59	8687762	8998775	9319714	9651268	9994184	1
60	8692867	9004040	9325151	9656888	1000000	0
	49	48	47	46	45	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	45	46	47	48	
0	10000000	10355302	10723686	11106124	60
1	10005820	10361332	10729942	11112623	59
2	10011643	10367365	10736202	11119126	58
3	10017469	10373402	10742466	11125634	57
4	10023299	10379443	10748734	11132146	56
5	10029132	10385487	10755006	11138662	55
6	10034968	10391535	10761282	11145182	54
7	10040808	10397587	10767562	11151706	53
8	10046651	10403643	10773845	11158235	52
9	10052497	10409702	10780132	11164768	51
10	10058347	10415765	10786423	11171305	50
11	10064201	10421832	10792718	11177846	49
12	10070058	10427902	10799017	11184393	48
13	10055918	10433976	10805320	11190942	47
14	10081782	10440054	10811625	11197496	46
15	10087649	10446135	10817938	11204054	45
16	10093520	10452220	10824253	11210617	44
17	10099394	10458309	10830572	11217184	43
18	10105271	10464401	10836895	11223755	42
19	10111153	10470497	10843222	11230330	41
20	10117038	10476597	10849554	11236910	40
21	10122926	10482701	10855889	11243494	39
22	10128818	10488808	10862228	11250082	38
23	10134713	10494919	10868571	11256675	37
24	10140611	10501034	10874918	11263272	36
25	10146513	10507152	10881269	11269873	35
26	10142418	10513275	10887624	11276478	34
27	10158327	10519401	10893983	11283088	33
28	10164229	10525531	10900146	11289702	32
29	10170154	10531664	10906713	11296321	31
30	10176073	10537801	10913084	11202944	30
	44	43	42	41	

The minutes of deg. of the Quadrant for the Tangents of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for Tangents of the arches of the ſame Quadrant.

	45	46	47	48	
30	10176073	10537801	10913084	11302944	30
31	10181996	10543942	10919459	11309571	29
32	10187922	10550087	10925838	11316203	28
33	10193852	10556235	10932221	11322839	27
34	10199785	10562387	10938608	11329480	26
35	10205722	10568543	10945000	11336125	25
36	10211663	10574703	10951396	11342774	24
37	10217607	10580867	10957796	11349428	23
38	10223555	10587034	10964200	11356086	22
39	10229506	10593205	10970608	11362748	21
40	10235460	10599380	10977020	11369415	20
41	10241418	10605559	10983436	11376086	19
42	10247386	10611742	10989856	11382762	18
43	10253345	10617929	10996280	11389442	17
44	10259314	10624119	11002708	11396126	16
45	10265286	10630313	11009140	11402815	15
46	10271262	10636511	11015577	11409508	14
47	10277242	10642713	11022018	11416206	13
48	10283225	10648919	11028463	11422908	12
49	10289212	10655128	11034912	11429615	11
50	10295203	10661341	11041365	11436326	10
51	10301196	10667558	11047822	11443042	9
52	10307193	10673779	11054283	11449762	8
53	10313194	10680004	11060748	11456487	7
54	10319199	10686233	11067218	11463216	6
55	10325207	10692466	11073692	11469950	5
56	10331219	10698702	11080170	11476688	4
57	10337234	10704942	11086652	11483431	3
58	10243253	10711186	11093138	11490178	2
59	10349276	10717434	11099629	11496929	1
60	10355302	10723686	11106124	11503684	0
	44	43	42	41	

The minutes of deg. of the Quadrant for Tangents of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	49	50	51	52	
0	11503684	11917537	12348972	12799416	60
1	11510444	11924580	12356320	12807093	59
2	11517208	11931628	12363973	12814776	58
3	11523977	11938680	12371032	12822469	57
4	11530751	11945737	12378394	12830159	56
5	11537529	11952799	12385762	12837859	55
6	11544312	11959866	12393126	12845565	54
7	11551100	11966938	12400515	12853277	53
8	11557893	11974015	12407899	12860994	52
9	11564691	11981097	12415288	12868717	51
10	11571494	11988183	12422683	12876445	50
11	11578301	11995274	12430083	12884779	49
12	11585112	12002370	12437489	12891919	48
13	11591928	120 9471	12444900	12899665	47
14	11598748	12016578	12452317	12907417	46
15	11605572	12023690	12459739	12915175	45
16	11612401	12030807	12467167	12922939	44
17	11619234	12037929	12474600	12930709	43
18	11626072	12045056	12482039	12938485	42
19	11632915	12052188	12489484	12946267	41
20	11629763	12059325	12496934	12954055	40
21	11646615	12066467	12504389	12961848	39
22	11653472	12073614	12511850	12969647	38
23	11660334	12080766	12519316	12977452	37
24	11667200	12087923	12526787	12985262	36
25	11674071	12095085	12534264	12993080	35
26	11680047	12102252	12541746	13000903	34
27	11687827	12109424	12549233	13008732	33
28	11694712	12116601	12556725	13016567	32
29	11701601	12123783	12564222	13024407	31
0	11708497	12130970	12571724	1303225	30
	40	39	38	37	

The minutes of deg. of the Quadrant for the Tangents of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	49	50	51	52	
30	11708497	12130970	12571724	13032253	30
31	11715396	12138162	12579232	13040105	29
32	11722300	12145259	12586746	13047963	28
33	11729208	12152561	12594265	13055827	27
34	11736121	12159768	12601790	13063697	26
35	11743039	12166981	12609321	13071573	25
36	11749963	12174199	12616858	13079455	24
37	11756889	12181422	12624400	13087343	23
38	11762821	12188650	12631948	13095237	22
39	11770758	12195882	12639501	13103138	21
40	11777700	12203121	12647060	13111045	20
41	11784640	12210364	12654624	13115958	19
42	11791597	12217613	12662194	13126877	18
43	11798553	12224867	12669769	13134802	17
44	11805514	12232126	12677350	13142732	16
45	11812479	12239391	12684937	13150668	15
46	11819449	12246659	12692530	13158610	14
47	11836424	12253933	12700128	13106558	13
48	11833404	12261212	12707732	13174517	12
49	11840388	12268490	12715341	13182472	11
50	11847377	12275786	12722956	13190438	10
51	11854371	12283081	12730577	13198411	9
52	11861370	12290381	12738203	15206390	8
53	11868374	12297687	12745835	13214375	7
54	11875381	12303998	12753473	13222267	6
55	11882397	12312314	12761116	13230365	5
56	11889417	12319635	12768765	13238269	4
57	11896438	12326961	12776422	13246379	3
58	11902466	12334292	12784080	13254296	2
59	11910499	12341632	12791745	13262419	1
60	11917537	12348972	12790416	13270448	0
	40	39	38	37	

The minutes of deg. of the Quadrant for the Tangents of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for Tangents

The minutes of the degrees of the Quadrant for Tangents of the arches of the ſame Quadrant.

	53	54	55	56	
0	13270448	13763820	14281480	14825610	60
1	13278483	13772243	14290325	14834916	59
2	13286524	13780673	14299177	14844230	58
3	13294571	13789109	14308037	14853553	57
4	13302624	13797552	14316905	14862884	56
5	13310683	13800002	14325780	14872223	55
6	13318749	13874459	14334662	14881570	54
7	13326821	13822922	14343552	14890925	53
8	13334899	13831392	14352451	14900288	52
9	13342984	13839869	14361354	14909659	51
10	13351075	13848352	14370266	14919038	50
11	13359172	13856842	14379186	14928426	49
12	13367276	13865339	14388114	14937822	48
13	13375386	13873843	14397048	14947226	47
14	13383502	13882354	14405990	14956638	46
15	13391624	13890872	14414939	14966058	45
16	13399753	13899397	14423896	14975486	44
17	13407888	13907930	14432861	14984921	43
18	13416029	13916470	14441833	14994368	42
19	13424177	13925017	14450812	15003821	41
20	13432331	13933571	14459799	15013282	40
21	13440492	13942131	14468794	15022753	39
22	13448659	13950698	14477797	15032231	38
23	13456832	13959272	14486807	15041717	37
24	13465011	13967853	14495825	15051211	36
25	13473197	13976441	14504850	15060714	35
26	13481390	13985035	14513883	15070225	34
27	13486589	13993636	14522924	15079744	33
28	13497794	14002244	14531972	15089271	32
29	13506006	14010859	14541028	15098807	31
30	13514224	14019481	14550091	15108351	30
	36	35	34	33	

The minutes of deg. of the Quadrant for Tangents of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for Tangents

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of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	53	54	55	56	
30	13514224	14019481	14550091	15108351	30
31	13522449	14028110	14559162	15117903	29
32	13530686	14036746	14568241	15127464	28
33	13538918	14045389	14577327	15137034	27
34	13547162	14054040	14586421	15146612	26
35	13555413	14062698	14595523	15156199	25
36	13563670	14071363	14604633	15165794	24
37	13571934	14080035	14613750	15175398	13
38	13580204	14088715	14622875	15185011	22
39	13588481	14097402	14632007	15194632	21
40	13596764	14106097	14641146	15204261	20
41	13605054	14114798	14650293	15213899	19
42	13613350	14123506	14659449	15223545	18
43	13621653	14132221	14668613	15233200	17
44	13629963	14140943	14677785	15242863	16
45	13638279	14149672	14686965	15252535	15
46	13646602	14158409	14696153	15262216	14
47	13654932	14167153	14705349	15271905	13
48	13663268	14175904	14714553	15281603	12
49	13671610	14184663	14723765	15291309	11
50	13679959	14193429	14732985	15301024	10
51	13688315	14202202	14742212	15310748	9
52	13696677	14210982	14751447	15320481	8
53	13705046	14219769	14760690	15330222	7
54	13713422	14228563	14769941	15339972	6
55	13721805	14237365	14779200	15349730	5
56	13730194	14246174	14788466	15359497	4
57	13738590	14254990	14797740	15369273	3
58	13746993	14263813	14807022	15379057	2
59	13755403	14272643	14816312	15388850	1
60	13763820	14281480	14825610	15398651	0
	36	35	34	33	

The minutes of deg. of the Quadrant for the Tangents of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	57	58	59	60	
0	15398651	16003347	16642794	17320508	60
1	15408461	16013710	16653766	17332150	59
2	15418280	16024083	16664749	17343804	58
3	15428108	16034466	16675742	17355469	57
4	15437945	16044859	16686746	17367146	56
5	15447791	16055261	16697760	17378834	55
6	15457646	16065673	16708785	17390534	54
7	15467510	16076095	16719820	17402246	53
8	15477382	16086527	16730866	17413969	52
9	15487263	16096968	16741922	17425704	51
10	15497153	16107419	16752989	17437451	50
11	15507052	16117880	16764067	17449210	49
12	15516960	16128351	16775156	17460981	48
13	15526877	16138832	16786256	17472704	47
14	15536803	16149322	16797367	17484559	46
15	15546738	16159822	16808489	17496366	45
16	15556682	16170332	16819621	17508185	44
17	15566636	16180852	16830764	17520026	43
18	15576599	16191381	16841918	17531869	42
19	15586571	16201920	16853083	17543724	41
20	15596552	16212469	16864259	17555591	40
21	15606542	16223028	16875446	17567470	39
22	15616541	16233597	16886644	17579362	38
23	15626549	16244176	16897853	17591266	37
24	15636566	16254766	16909074	17603182	36
25	15646592	16265366	16920306	17615111	35
26	15656627	16275976	16931549	17627052	34
27	15666671	16286596	16942809	17639006	33
28	15676724	16297226	16954060	17650972	32
29	15686780	16307866	16965344	17662951	31
30	15696857	16318516	16976631	17674941	30
	32	31	30	29	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	57	58	59	60	
30	15696857	16318516	16976631	17674941	30
31	15706938	16329176	16987929	17686945	29
32	15717028	16339847	16999239	17698960	28
33	15727127	16350528	17010560	17710987	27
34	15737235	19361219	17021892	17723027	26
35	15747353	16371920	17033236	17735079	25
36	15757480	16382631	17044591	17747143	24
37	15767616	16393352	17055957	17759220	23
38	15777761	16404083	17067325	17771309	22
39	15787915	16414824	17078714	17783410	21
40	15798078	16425575	17090115	17795524	20
41	15808251	16436337	17101527	17807651	19
42	15818433	16447109	17112950	17819790	18
43	15828625	16457892	17124384	17831942	17
44	15838827	16468685	17135829	17844107	16
45	15849038	16479488	17147285	17856285	15
46	15859259	16490302	17158752	17868475	14
47	15869489	16501126	17170231	17880678	13
48	15879729	16511960	17181721	17892894	12
49	15889979	16522805	17193222	17905123	11
50	15900238	16533660	17204734	17917364	10
51	15910507	16544526	17216258	17929618	9
52	15920785	16555402	17227794	17941885	8
53	15931073	16566289	17239342	17954164	7
54	15941370	16577186	17250902	17966456	6
55	15951676	16588094	17262473	17978761	5
56	15961992	16599013	17274056	17991079	4
57	15972317	16609942	17285651	18003410	3
58	15982651	16620882	17297258	18015753	2
59	15992994	16631833	17308877	18028109	1
60	16003347	16642794	17320508	18040478	0
	32	31	30	29	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	61	62	63	64	
0	18040478	18807265	19626104	20503034	60
1	18052860	18820471	19640225	20518180	59
2	18065255	18833691	19654362	20533344	58
3	18077663	18846925	19668516	20548526	57
4	18090084	18860174	19682686	20563726	56
5	18102518	18873437	19696874	20578945	55
6	18114966	18886715	19711074	20594182	54
7	18127427	18900007	19725293	20609437	53
8	18139901	18913314	19739528	20624711	52
9	18152388	18926636	19753760	20640003	51
10	18164889	18939972	19768048	20655313	50
11	18177403	18953323	19782333	20670642	49
12	18189930	18966689	19796634	20685989	48
13	18202470	68980070	19810951	20701355	47
14	18215024	18993466	19825285	20716739	46
15	18227591	19006876	19839635	20732142	45
16	18240171	19020301	19854002	20747564	44
17	18252765	19033741	19868386	20763004	43
18	18265372	19047196	19882786	20778463	42
19	18277992	19060665	19897203	20793941	41
20	18290626	19074149	19911637	20809438	40
21	18303273	19087648	19926088	20824953	39
22	18315934	19101162	19940555	20840487	38
23	18328608	19114691	19955039	20856040	37
24	18341296	19128235	19969540	20871612	36
25	18353997	19141795	19984057	20887202	35
26	18366712	19155370	19998591	20902811	34
27	18379440	19168960	20013142	20918439	33
28	18391182	19182565	20027709	20934086	32
29	18404938	19196185	20042297	20949752	31
30	18417707	19209821	20056898	20965436	30
	28	27	26	25	

The minutes of deg. of the Quadrant for the Tangents of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	61	62	63	64	
30	18417707	19209821	20056898	20965436	30
31	18430490	19223472	20071516	20981140	29
32	18443287	19237138	20086152	20996863	28
33	18456098	19250819	20100805	21011605	27
34	18468922	19264516	20115475	21028367	26
35	18481760	19278228	20130163	21044148	25
36	18494612	19291955	20144868	21059949	24
37	18507478	19305698	20159590	21075769	23
38	18520357	19319456	20174329	21091609	22
39	18533250	19333230	20189086	21107468	21
40	18546157	19347019	20203860	21123347	20
41	18559078	19360824	20218651	21139246	19
42	18572013	19374644	20233460	21155164	18
43	18584962	19388480	20248286	21171102	17
44	18597625	19402331	20263130	21187059	16
45	18610902	19416198	20277991	21203036	15
46	18623894	19430081	20292870	21219032	14
47	18636900	19443980	20307767	21235048	13
48	18649920	19457894	20322681	21251083	12
49	18662954	19471824	20337613	21267138	11
50	18676002	19485770	20352563	21283213	10
51	18689064	19499732	20367531	21299308	9
52	18702140	19513710	20382516	21315423	8
53	18715231	19527704	20397519	21331558	7
54	18728335	19541714	20412539	21347713	6
55	18741454	19555739	20427577	21363888	5
56	18754587	19569780	20442633	21380083	4
57	18767335	19583837	20457706	21396298	3
58	18780897	19597910	20472797	21412534	2
59	18794074	19611999	20487906	21428790	1
60	18807265	19626104	20503034	21445067	0
	28	27	26	25	

The minutes of deg. of the Quadrant for the Tangents of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the same Quadrant.

	65	66	67	68	
0	21445067	22460375	23558529	24750869	60
1	21461364	22477965	23577595	24771613	59
2	21477681	22495582	23596687	24792387	58
3	21494019	22513222	23615805	24813191	57
4	21510377	22530885	23634950	24834024	56
5	21526756	22548571	23654121	24854887	55
6	21543155	22566281	23673318	24875780	54
7	21559575	22584014	23692542	24896704	53
8	21576015	22601771	23711793	24917659	52
9	21592475	22619551	23731071	24938644	51
10	21608956	22637355	23750375	24959659	50
11	21625458	22655183	23769706	24980705	49
12	21641981	22673034	23789064	25001782	48
13	21658525	22690909	23808448	25022890	47
14	21675090	22708808	23827859	25044029	46
15	21691670	22726730	23847197	25065198	45
16	21708283	22744676	23866762	25086398	44
17	21724911	22762646	23886254	25107629	43
18	21741559	22780639	23900773	25128891	42
19	21758228	22798656	23925320	25150183	41
20	21774918	22816696	23944895	25171506	40
21	21791629	22834760	23964499	25192861	39
22	21808362	22852848	23984124	25214248	8
23	21825116	22870960	24003779	25235666	37
24	21841803	22889096	24023462	25257116	36
25	21858089	22907256	24043172	25278597	35
26	21875508	22925441	24062910	25300110	34
27	21892348	22943650	24082675	25321655	33
28	21909210	22961883	24102468	25343231	32
29	21926094	22980141	24122289	25364849	31
30	21943000	22998424	24142137	2538648	30
	24	23	22	21	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the same Quadrant.

The degrees of the Quadrant for the Tangents

of the arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the same Quadrant.

	65	66	67	68	
30	21943000	22998424	24142137	25386482	30
31	21959926	23016731	24162013	25408154	29
32	21976874	23035062	24181917	25429858	28
33	21993843	23053418	24201849	25451594	27
34	22010824	23071798	24221809	25473362	26
35	22027846	23090263	24241798	25495162	25
36	22044879	23108632	24261815	25516995	24
37	22061934	23127086	24281860	25538861	23
38	22079011	23145565	24301934	25560758	22
39	22096109	23164068	24322037	25582688	21
40	22113229	23182597	24342169	25604651	20
41	22130372	23221151	24363329	25626647	19
42	22147537	23219730	24382518	25648675	18
43	22164725	23238335	24402735	25670736	17
44	22181935	23256965	24422981	25692830	16
45	22199168	23275621	24443256	25714957	15
46	22216424	23294302	24463559	25737118	14
47	22233703	23313008	24483891	25759312	13
48	22251004	23331740	24504252	25781540	12
49	22268328	23350498	24524641	25803801	11
50	22285675	23369282	24545061	25826096	10
51	22303044	23388092	24565509	25848424	9
52	22320435	23406927	24585986	25870786	8
53	22337848	23425788	24606492	25893181	7
54	12355284	23444674	24627028	25915610	6
55	22372742	23463586	24647594	25938073	5
56	22390223	23482523	24668189	25960569	4
57	22407726	23501486	24688814	25983099	3
58	22425252	23520475	24709469	26005663	2
59	22442800	23539489	24730154	26028261	1
60	22460371	23558529	24750869	26050892	0
	24	23	22	21	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the same Quadrant.

of the complements of the arches of the same Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	69	70	71	72	
0	26050893	27474777	29042105	30776834	60
1	26073559	27499665	29069569	30807323	59
2	26096260	27524592	29097079	30837866	58
3	26118996	27549559	29124636	30868465	57
4	26141766	27574565	29152243	30899119	56
5	26164570	27599612	29179895	30929828	55
6	26187410	27624699	29207595	30960593	54
7	26210286	27649827	29235343	30991413	53
8	26233196	27674995	29263139	31022289	52
9	26256141	27700204	29290982	31053221	51
10	26279120	27725453	29318873	31084208	50
11	26302135	27750742	29346811	31115252	49
12	26325185	27776072	29374797	31146352	48
13	26348270	27801443	29402831	31177508	47
14	26371390	27826855	29430913	31208720	46
15	26394546	27852308	29459043	31239989	45
16	26417738	27877803	29487221	31271315	44
17	26440966	27903339	29515446	31302698	43
18	26464229	27928917	29543719	31334138	42
19	26487528	27954536	29572041	31365636	41
20	26510863	27980196	29600411	31397191	40
21	26534234	28005898	29628831	31428805	39
22	26557641	28031642	29657301	31460476	38
23	26581084	28057429	29685820	31492205	37
24	26604563	28083258	29714388	31523992	36
25	26628079	28109129	29743006	31555838	35
26	26651631	28135043	29771674	31587742	34
27	26675220	28160999	29800392	31619705	33
28	26698845	28186998	29829160	31651727	32
29	26722507	28213040	29857978	31683807	31
30	26746206	28239125	29886847	31715946	30
	20	19	18	17	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	69	70	71	72	
30	26746206	28239125	29886847	31715946	30
31	26769942	28265253	29915765	31748144	29
32	26793716	28291424	29944734	31780401	28
33	26817527	28317638	29973753	31812717	27
34	26840375	28343895	30002823	31845093	26
35	26865260	28370195	30031943	31877528	25
36	26889183	28396539	30061113	31910024	24
37	26913143	28422926	30090334	31942580	23
38	26937141	28449357	30119605	31975197	22
39	26961177	28475832	30148927	32007875	21
40	26985251	28502350	30178299	32040613	20
41	27009362	28528913	30207723	32073413	19
42	27033511	28555520	30237200	32106275	18
43	27057698	28582172	30266730	32139200	17
44	27081922	28608868	30296312	32172187	16
45	27106184	28635608	30335947	32205237	15
46	27130484	28662393	30355635	32238349	14
47	27154823	28689223	30385375	32271524	13
48	27179200	28716096	30415169	32304762	12
49	27203616	28743015	30445015	32338064	11
50	27228070	28769979	30474915	32371430	10
51	27252563	28796987	30504867	32404858	9
52	27277095	28824040	30534872	32438348	8
53	27301667	28851139	30564930	32471901	7
54	27326278	28878283	30595041	32505517	6
55	27350929	28905472	30625205	32539196	5
56	27375620	28932707	30655423	32572937	4
57	27400350	28959988	30685695	32606741	3
58	27425120	28987315	30716030	32640607	2
59	27449929	29014687	30746400	32674536	1
60	27474777	29042105	30776834	32708528	0
	20	19	18	17	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	73	74	75	76	
	32708528	34874144	37320507	40107808	60
1	32742588	34912470	37363980	40157569	59
2	32776715	34950874	37407546	40207446	58
3	32810090	34989356	37451207	40257440	57
4	32845164	35027916	37494964	40307552	56
5	32879487	35066555	37538814	40357781	55
6	32913876	35105273	37582760	40408129	54
7	32948330	35144070	37626802	40458596	53
8	32982851	35182946	37670943	40509173	52
9	33017437	35221901	37715180	40559877	51
10	33052092	35260938	37759515	40610700	50
11	33086811	35300054	37803948	40661645	49
12	33121598	35349253	37848479	40712707	48
13	33156452	35378528	37893109	40763892	47
14	33191373	35417886	37937838	40815198	46
15	33226362	35457325	37982666	40866627	45
16	33261419	35496846	38027586	40918178	44
17	33296543	35536445	38072609	40969851	43
18	33331736	35576132	38117746	41021649	42
19	33366997	35615900	38162997	41073567	41
20	33402226	35655749	38208285	41125614	40
21	33437724	35695682	38253708	41177784	39
22	33473191	35735695	38299232	41230079	38
23	33508725	35775794	38344857	41282499	37
24	33544330	35815973	38390591	41335045	36
25	33580005	35856241	38436424	41387719	35
26	33615750	35896595	38482357	41440519	34
27	33651566	35937026	38528294	41493447	33
28	33687453	35977546	38574535	41546501	32
29	33723410	36018146	38620782	41599683	31
30	33759438	36058835	38667131	41652998	30
	16	15	14	13	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	73	74	75	76	
30	33759436	36058835	38667135	41652998	30
31	33795532	36099609	38713584	41706440	29
32	33831698	36140469	38760142	41760011	28
33	33867940	36181417	38806804	41813712	27
34	33904250	36222446	38853574	41867550	26
35	33940632	36263569	38900448	41921510	25
36	33977086	36304771	38947426	41975607	24
37	34013613	36346060	38994516	42029834	23
38	34050212	36387444	39041710	42084195	22
39	34086884	36428911	39089011	42138690	21
40	34123626	36470469	39136420	42193314	20
41	34160443	36512113	39183996	42248080	19
42	34197335	36553843	39231564	42302977	18
43	34234297	36595665	39279294	42358009	17
44	34271324	36637574	39327139	42413177	16
45	34308446	36679574	39375094	42468482	15
46	34345621	36721066	39423158	42523923	14
47	34382891	36763848	39471331	42579501	13
48	34420226	36806124	39519614	42635218	12
49	34457635	36848475	39568006	42691072	11
50	34495120	36890926	39616518	42747066	10
51	34532679	36933469	39665134	42803199	9
52	34570315	36976104	39712868	42859468	8
53	34608026	37018829	39762712	42915888	7
54	34645813	37064649	39811669	42972439	6
55	34683679	37104560	39860739	43029132	5
56	34721615	57147564	39909924	43015674	4
57	34759632	37190658	39959218	43142937	3
58	34797726	37233847	40008633	43200079	2
59	34835896	37277131	40058163	43257248	1
60	34874144	37320507	40107808	43314799	0
	16	15	14	13	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	77	78	79	80	
0	43314759	47046299	51445543	56712854	60
1	43372316	47113686	51525556	56809480	59
2	43430019	47181259	51605817	56906425	58
3	43487868	47249013	51686311	57003690	57
4	43545855	47316952	51767055	57101277	56
5	43603999	47385083	51848095	57199188	55
6	43662290	47453400	51929265	57297425	54
7	43720729	47521907	52010738	57395990	53
8	43779317	47590605	52092455	57494885	52
9	43838055	47659490	52174425	57594111	51
10	43896943	47728568	52256643	57693670	50
11	43955982	47797839	52339110	57793564	49
12	44015170	47867299	52421837	57893795	48
13	44074511	47936958	52504806	57994366	47
14	44133995	48006868	52588038	58095279	46
15	44193637	48076854	52671515	58196536	45
16	44253425	48147096	52755259	58298138	44
17	44313387	48217536	52839251	58400087	43
18	44373394	48288172	52923503	58502385	42
19	44433756	48359008	53008016	58605034	41
20	44494174	48430043	53092792	58708035	40
21	44554749	48501282	53177831	58811388	39
22	44615481	48572719	53263134	58915095	38
23	44676371	48644359	53348702	59019157	37
24	44737419	48716199	53434436	59123576	36
25	44798636	48788248	53520637	59228353	35
26	44859999	48860498	53607006	59333490	34
27	44921531	48932955	53693644	59438989	33
28	44983221	49005620	53780552	59544852	32
29	45045068	49078493	53867731	59651081	31
30	45107083	49151565	53955183	59757678	30
	12	11	10	9	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	77	78	79	80	
30	45107083	49151568	53955183	59757678	30
31	45169263	49224858	54042909	59864646	29
32	45231607	49298357	54130911	59971987	28
33	45294104	49372069	54219190	60079703	27
34	45356775	49445993	54307748	60187796	26
35	45419607	49520130	54396586	60296268	25
36	45482605	49594474	54485705	60405121	24
37	45545780	49669037	54575107	60514358	23
38	45609113	49743819	54664793	60623981	22
39	45672613	49818814	54754764	60733992	21
40	45736287	49894026	54845022	60844392	20
41	45800128	49969459	54935569	60955184	19
42	45864141	50045111	55026406	61066370	18
43	45928324	50120984	55117535	61177952	17
44	45992680	50197078	55208958	61289930	16
45	46057206	50273397	55300676	61402307	15
46	46121908	50349935	55392692	61515085	14
47	46186783	50426702	55485007	61628267	13
48	46251832	50503790	55577622	61741856	12
49	46317056	50580918	55670539	61855854	11
50	46382455	50658357	55763759	61970263	10
51	46448034	50736025	55857283	62085085	9
52	46513788	50813927	55951112	6220022	8
53	46579721	50892060	56045247	62315979	7
54	46645823	50970425	56139689	6243205	6
55	46712125	51049023	56234439	6254855	5
56	46778597	51127855	56329498	62665481	4
57	46845248	51206922	56424868	62782833	3
58	46912085	51286225	56520550	62900615	2
59	46979099	51365765	56616545	6301882	1
60	47046299	51445543	56712854	6313747	0
	12	11	10	9	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	81	82	83	84	
0	63137478	71153707	81443502	95143611	60
1	63256564	71304198	81639821	95410585	59
2	63376089	71455313	81837074	95679034	58
3	63496056	71607058	82035268	95948971	57
4	63616468	71759440	82234410	96220411	56
5	63737327	71912459	82434508	96493467	55
6	63858635	72066117	72635570	96767939	54
7	63980394	72220422	82837603	97044063	53
8	64102607	72375376	83040614	97321646	52
9	64225276	72530983	83244610	97600890	51
10	64348404	72687247	83449598	97881716	50
11	64471994	72844173	83655585	98164135	49
12	64596049	73001766	83862572	98448162	48
13	64720571	73160031	84070565	98733810	47
14	64845563	73318972	84279571	99021104	46
15	64971028	73478593	84489598	99310047	45
16	65096969	73638898	84700687	99600656	44
17	65223388	73799892	84912817	99893942	43
18	65350287	73961579	85125995	100186022	42
19	65477669	74123964	85340229	100482822	41
20	65605537	74287052	85555525	100780346	40
21	65733894	74450847	85771891	101079507	39
22	65862743	74615354	85989335	101380525	38
23	65992087	74780577	86207866	101683314	37
24	66121928	74946021	86427493	101987889	36
25	66252268	75113189	86648225	102294266	35
26	66383110	75280586	86870072	102602473	34
27	66514457	75448716	87093043	102912514	33
28	66646313	75617584	87217150	103224405	32
29	66778681	75787195	87542404	103538166	31
30	66911564	75957554	87768816	103853919	30
	8	7	6	5	

The minutes of deg. of the Quadrant for the Tangents of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	81	82	83	84	
30	66911564	75957554	87768816	103853919	30
31	67044965	76128666	87996394	104171468	29
32	67178887	76300536	88225146	104491055	28
33	67313334	76473170	88455079	104812581	27
34	67448309	76646573	88686196	105136063	26
35	67583815	76820751	88918508	105461519	25
36	67719855	75995710	89152021	105788969	24
37	67856433	77172455	89386745	106118428	23
38	67993549	77347991	89622688	106449917	22
39	68131209	77525324	89859858	106783466	21
40	68269416	77703459	90098268	107119198	20
41	68408173	77882402	90337927	107456902	19
42	68547437	78062159	90578848	107796712	18
43	68687350	78242737	90821043	108138767	17
44	68827777	78424142	91064526	108482852	16
45	68968769	78606379	91309309	108829233	15
46	69110326	78789454	91555401	109177805	14
47	69252455	78973371	91802810	109528589	13
48	69395158	79158136	92051546	109881098	12
49	69538439	79343754	92301618	110236864	11
50	69682202	79530231	92553036	110594415	10
51	69826751	79717572	92805759	110954264	9
52	69971789	79905783	93059875	111316432	8
53	70117419	80094809	93315961	111680940	7
54	70263645	80284835	93572238	112047814	6
55	70410470	80475688	93830595	112417202	5
56	70557898	80667435	94090270	112788878	4
57	70705932	80860082	94351448	113163650	3
58	70854576	81053639	94614055	113529681	2
59	71003833	81248110	94878103	113918875	1
60	71153706	81443502	95143611	114300579	0
	8	7	6	5	

The minutes of deg. of the Quadrant for the Tangents of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	85	86	87	
0	114399579	143006601	190811200	60
1	114684819	143606943	191879163	59
2	115071619	144212307	192959095	58
3	115461005	144822757	194051200	57
4	115803017	145438358	195155685	56
5	116247668	146059171	196273146	55
6	116644985	146685275	197403054	54
7	117044995	147316726	198545993	53
8	117447864	147953611	199702191	52
9	117853346	148595987	200871878	51
10	118261757	149244148	202055705	50
11	118672834	149897753	203253093	49
12	119086890	150557233	204464726	48
13	119503669	151222301	205691260	47
14	119923488	151893462	206932111	46
15	120346233	152570581	208188402	45
16	120771937	153253487	209459545	44
17	121200643	153942729	210746693	43
18	121632370	154638158	212049271	42
19	122067151	155339855	213368214	41
20	122505017	156047923	214704085	40
21	122946003	156762433	216056022	39
22	123390142	157483474	217425507	38
23	123837634	158111136	218812405	37
24	124288195	158945509	220217049	36
25	124742169	159686753	221639784	35
26	125199280	160434770	223080983	34
27	125659878	161189849	224540987	33
28	126123842	161952305	226020167	32
29	126591211	162721698	227518902	31
30	127062036	163498660	229037584	30
	4	3	2	

The minutes of deg. of the Quadrant for the Tangents of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

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of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	85	86	87	
30	127062036	163498660	229037584	30
31	127536341	164282764	230576614	29
32	128014165	165074651	232136427	28
33	129495548	105873906	233717425	27
34	128980531	166681172	235320041	26
35	129469305	167496287	236945285	25
36	129961652	168319085	238592501	24
37	130457692	169150247	240262714	23
38	130957670	169989613	241957021	22
39	131461286	170837304	243674732	21
40	131968920	171693461	245417543	20
41	132480297	172558198	247184785	19
42	132995769	173431641	248978216	18
43	133515636	174313925	250797165	17
44	134038804	175205183	252643455	16
45	134566419	176105555	254517088	15
46	135098153	177015180	256417991	14
47	135634096	177934219	258348100	13
48	136174272	178862806	260307416	12
49	136718731	179801085	262296605	11
50	137267523	180749537	264316358	10
51	137820702	181707670	266366704	9
52	138378219	182676299	268449755	8
53	138940429	183654941	270565570	7
54	139507087	184644417	272714927	6
55	140078545	185644562	274898633	5
56	140654481	186655202	277117516	4
57	141235334	188677270	279372435	3
58	141820765	188710414	281664304	2
59	142411234	189755028	283964009	1
60	143006601	190811200	286362498	0
	4	3	2	

The minutes of deg. of the Quadrant for the Tangents of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	88		89	
0	286362498		572899830	60
1	288770746		582610421	59
2	291219764		592655713	58
3	293710598		603057015	57
4	296244357		613825994	56
5	298823024		624990311	55
6	301445987		636564040	54
7	304115322		648591509	53
8	306833212		661050728	52
9	309599077		674016435	51
10	312416191		687500725	50
11	315283945		701531474	49
12	318204757		716149676	48
13	321181137		731365593	47
14	324212583		747289264	46
15	327302782		763899813	45
16	330451272		781259259	44
17	333661982		799432199	43
18	336934467		818463792	42
19	340272744		838430438	41
20	344677949		859395474	40
21	347150587		881427652	39
22	350695255		904627361	38
23	354312962		929081086	37
24	358006024		954893332	36
25	361776788		982180553	35
26	365626388		1011062679	34
27	369560062		1041705454	33
28	373579199		1074262399	32
29	377686614		1108922084	1
30	381885288		1145891136	30
	I		O	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Tangents

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Tangents of the arches of the ſame Quadrant.

	88		89	
30	381885288		11458911 6	30
31	386178258		1185395877	29
32	390568737		1227736470	28
33	395060088		1273213435	27
34	399655828		1322188681	26
35	404359642		1375082163	25
36	409175388		1432363027	24
37	414111295		1494645462	23
38	419159137		1562590046	22
39	424335793		1637 05697	21
40	429641796		1718863124	20
41	435082056		1809337410	19
42	440661780		1909864971	18
43	446386310		2022219818	17
44	452261453		2148619711	16
45	458293185		2291873854	15
46	464487853		2455522838	14
47	470852152		2644433955	13
48	477392195		2864819229	12
49	4841 8353		3125276745	11
50	491038024		3437820002	10
51	498155754		3819696333	9
52	505482720		4297181900	8
53	512020946		4911098124	7
54	520805157		5729633839	6
55	528821258		6875680006	5
56	537085003		8594002952	4
57	545610968		11457529506	3
58	554414914		17188033688	2
59	563504209		34376070815	1
60	572899830		INFINITA.	0
	I		O	

The minutes of deg. of the Quadrant for the Tangents of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

THE TABLE OF SECANTS, OTHERWISE CALLED THE BENEFICIAL *TABLE.*

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the same Quadrant.

	0	1	2	3	
0	10000000	10001524	10006095	10013723	60
1	10000001	10001574	10006198	10013875	59
2	10000002	10001626	10006301	10014029	58
3	10000004	10001679	10006405	10014184	57
4	10000008	10001733	10006509	10014339	56
5	10000010	10001788	10006615	10014495	55
6	10000014	10001844	10006721	10014653	54
7	10000020	10001900	10006828	10014811	53
8	10000027	10001957	10006936	10014970	52
9	10000034	10002015	10007045	10015130	51
10	10000042	10002074	10007155	10015291	50
11	10000051	10002134	10007265	10015453	49
12	10000060	10002193	10007376	10015615	48
13	10000071	10002256	10007488	10015780	47
14	10000080	10002318	10007601	10015942	46
15	10000005	10002381	10007716	10016107	45
16	10000108	10002445	10007831	10016273	44
17	10000122	10002508	10007946	10016440	43
18	10000137	10002570	10008062	10016608	42
19	10000152	10002642	10008179	10016777	41
20	10000168	10002709	10008298	10016946	40
21	10000186	10002777	10008417	10017616	39
22	10000204	10002846	10008537	10017287	38
23	10000220	10002916	10008658	10017459	37
24	10000243	10002987	10008779	10017632	36
25	10000264	10003058	10008902	10017806	35
26	10000285	10003130	10009025	10017981	34
27	10000308	10003203	10009149	10018157	33
28	10000332	10003277	10009274	10018333	32
29	10000357	10003352	10009400	10018510	31
30	10000381	10003428	10009527	10018687	30
	89	88	87	86	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the same Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the same Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the same Quadrant.

	0	1	2	3	
30	10000381	10003428	10009527	10018687	30
31	10000407	10003505	10009655	10018865	29
32	10000433	10003581	10009783	10019044	28
33	10000461	10003660	10009912	10019224	27
34	10000489	10003739	10010042	10019405	26
35	10000518	10003819	10010174	10019587	25
36	10000548	10003900	10010306	10019770	24
37	10000579	10003982	10010439	10019954	23
38	10000611	10004064	10010572	10020138	22
39	10000643	10004148	10010706	10020324	21
40	10000677	10004231	10010841	10020510	20
41	10000711	10004317	10010977	10020698	19
42	10000746	10004403	10011114	10020886	18
43	10000782	10004490	10011252	10021076	17
44	10000819	10004578	10011390	10021266	16
45	10000857	10004666	10011529	10021456	15
46	10000895	10004755	10011670	10021649	14
47	10000934	10004845	10011811	10021842	13
48	10000975	10004926	10011952	10022035	12
49	10001016	10005028	10012095	10022229	11
50	10001058	10005122	10012238	10022424	10
51	10001100	10005216	10011238	10022620	9
52	10001144	10005210	10012528	10022817	8
53	10001188	10005405	10012674	10023015	7
54	10001233	10005501	10012822	10023213	6
55	10001280	10005598	10012970	10023412	5
56	10001327	10005695	10013119	10023612	4
57	10001375	10005795	10013269	10023813	3
58	10001423	10005894	10013419	10024014	2
59	10001473	10005994	10013570	10024217	1
60	10001524	10006095	10013723	10024420	
	89	88	87	86	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the same Quadrant.

of the complements of the arches of the same Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	4	5	6	7	
0	10024420	10038198	10055082	10075098	60
1	10024625	10038454	10055390	10075459	59
2	10024830	10038710	10055699	10075820	58
3	10025036	10038968	10056009	10076182	57
4	10025242	10039226	10056320	10076545	56
5	10025450	10039486	10056632	10076909	55
6	10025658	10039747	10056944	10077274	54
7	10025868	10040008	10057256	10077639	53
8	10026078	10040269	10057570	10078005	52
9	10026289	10040532	10057884	10078372	51
10	10026500	10040796	10058200	10078740	50
11	10026713	10041061	10058517	10079109	49
12	10026927	10041326	10058834	10079479	48
13	10027141	10041592	10059153	10079850	47
14	10027357	10041859	10059472	10080222	46
15	10027573	10042128	10059792	10080595	45
16	10027790	10042397	10060113	10080968	44
17	10028009	10042667	10060435	10081342	43
18	10028227	10042936	10060757	10081717	42
19	10028447	10043207	10061080	10082093	41
20	10028667	10043479	10061405	10082470	40
21	10028889	10043752	10061730	10082848	39
22	10029111	10044025	10062056	10083226	38
23	10029334	10044300	10062383	10083606	37
24	10029559	10044576	10062711	10083987	36
25	10029784	10044853	10063039	10084368	35
26	10030009	10045130	10063369	10084750	34
27	10030236	10045409	10063700	10085134	33
28	10030463	10045689	10064031	10085518	32
29	10030692	10045969	10064364	10085903	31
30	10030922	10046250	10064696	10086289	30
	85	84	83	82	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	4	5	6	7	
30	10030922	10046250	10064696	10086289	30
31	10031152	10046532	10065032	10086677	29
32	10031381	10046815	10065365	10087065	28
33	10031614	10047098	10065701	10087454	27
34	10031846	10047383	10066038	10087843	26
35	10032079	10047669	10066376	10088233	25
36	10032314	10047954	10066715	10088623	24
37	10032550	10048241	10067054	10089015	23
38	10032786	10048529	10067394	10089408	22
39	10033023	10048818	10067735	10089802	21
40	10033261	10049107	10068076	10090196	20
41	10033500	10049398	10068419	10090592	19
42	10033740	10049690	10068763	10090988	18
43	10033981	10049983	10069107	10091385	17
44	10034223	10050276	10069452	10091783	16
45	10034465	10050571	10069798	10092182	15
46	10034708	10050865	10070146	10092582	14
47	10034952	10051160	10070495	10092983	13
48	10035196	10051456	10070842	10093385	12
49	10035441	10051752	10071192	10093787	11
50	10035688	10052051	10071542	10094190	10
51	10035936	10052350	10071895	10094594	9
52	10036184	10052649	10072247	10095000	8
53	10036432	10052951	10072600	10095406	7
54	10036682	10053252	10072954	10095816	6
55	10036931	10053555	10073310	10096221	5
56	10037185	10053858	10073666	10096630	4
57	10037436	10054162	10074023	10097040	3
58	10037690	10054468	10074380	10097451	2
59	10037944	10054775	10074737	10097863	1
60	10038118	10055082	10075098	10098275	0
	85	84	83	82	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	8	9	10	11	
0	10098275	10124650	10154264	10187160	60
1	10098689	10125117	10154786	10187743	59
2	10099103	10125585	10155308	10188320	58
3	10099518	10126054	10155831	10188899	57
4	10099934	10126524	10176356	10189478	56
5	10100351	10126994	10156881	10190058	55
6	10100769	10127465	10157407	10190639	54
7	10101188	10127937	10157934	10191221	53
8	10101607	10128410	10158462	10191804	52
9	10102028	10128884	10158991	10192387	51
10	10102450	10129358	10159520	10192972	50
11	10102872	10129834	10160051	10193557	49
12	10103295	10130311	20160582	10194144	48
13	10103720	10130788	10161114	10194732	47
14	10104544	10131266	10161648	10195320	46
15	10104570	10131746	10162182	10195910	45
16	10104996	10132226	10162717	10196500	44
17	10105423	10132707	10163252	10197092	43
18	10105851	10133189	10163789	10197684	42
19	10106280	10133672	10164327	10198277	41
20	10106710	10134156	10164865	10198872	40
21	10107140	10134641	10165405	10199467	39
22	10107572	10135127	10165944	10200063	38
23	10108005	10135614	10166485	10200660	37
24	10108438	10136102	10167028	10001258	36
25	10108873	10136591	10167571	10201857	35
26	10109309	10137080	10168116	10202457	34
27	10109745	10137571	10168661	10203058	33
28	10110182	10138063	10169207	10203659	32
29	10110620	10138555	10169755	10204262	31
30	10111059	10139048	10170303	10204867	30
	81	80	79	78	

The minutes of deg. of the Quadrant for the Secants of the arches of the cōplements of the ſame Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	8	9	10	11	
30	10111059	10139048	10170303	10204867	30
31	10111499	10139543	10170852	10205476	29
32	10111940	10140038	10171401	10206075	28
33	10112382	10140534	10171952	10206681	27
34	10112825	10141036	10172504	10207289	26
35	10113269	10241528	10173056	10207897	25
36	10113713	10142027	10173609	10208506	24
37	10114159	10142521	10174163	10209116	23
38	10114606	10143026	10174718	10209727	22
39	10115053	10143528	10175274	10210339	21
40	10115501	10144030	10175831	10210952	20
41	10115951	10144533	10176389	10211566	19
42	10116401	10145037	10176947	10212180	18
43	10116852	10145542	10177507	10212796	17
44	10117303	10146048	10178068	10213412	16
45	10117754	10146554	10178630	10214030	15
46	10118208	10147062	10179193	10214648	14
47	10118663	10147572	10179756	10217268	13
48	10119118	10148082	10180321	10215889	12
49	10119574	10148593	10180886	10216510	11
50	10120031	10149104	10181453	10217131	10
51	10120489	10149615	10182021	10217756	9
52	10120948	10150128	10182589	10218380	8
53	10121408	10150641	10183158	10219005	7
54	10121868	10151156	10183728	10219631	6
55	10122330	10151672	10184299	10220258	5
56	10122792	10152188	10184870	10220885	4
57	10123256	10152705	10185442	10221514	3
58	10123720	10152224	10186017	10222143	2
59	10124185	10153744	10186591	10222774	1
60	10124650	10154264	10187166	10222405	0
	81	80	79	78	

The minutes of deg. of the Quadrant for the Secants of the arches of the cōplements of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	12	13	14	15	
0	10223405	10263040	10306136	10352762	60
1	10224037	10263730	10306884	10353569	59
2	10224671	10264420	10307633	10354377	58
3	10225305	10265112	10308383	10355186	57
4	10225941	10265804	10309134	10355996	56
5	10226577	10266498	10309886	10356807	55
6	10227215	10267192	10310639	10357619	54
7	10227854	10267888	10311393	10358433	53
8	10228493	10268584	10312148	10359247	52
9	10229134	10269281	10312903	10360063	51
10	10229775	10269979	10313660	10360880	50
11	10230417	10270680	10314417	10361698	49
12	10231060	10271379	10315176	10362517	48
13	10231704	10272080	10315935	10363337	47
14	10232348	10272782	10316696	10364158	46
15	10232994	10273485	10317457	10364980	45
16	10233641	10274190	10318220	10365802	44
17	10234289	10274895	10318984	10366626	43
18	10234938	10275601	10319749	10367450	42
19	10235587	10276308	10320515	10368276	41
20	10236238	10277016	10321282	10369102	40
21	10236889	10277726	10322050	10369930	39
22	10237541	10278436	10322819	10370758	38
23	10238195	10279148	10323589	10371588	37
24	10238849	10279860	10324359	10372418	36
25	10239505	10280573	10325131	10373250	35
26	10240161	10281287	10325903	10374082	34
27	10240818	10282002	10326677	10374916	33
28	10241476	10282717	10327451	10375750	32
29	10242135	10283434	10328227	10370586	31
30	10242795	10284151	10329003	10377422	30
	77	76	75	74	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

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of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	12	13	14	15	
30	10242795	10284151	10329003	10377422	30
31	10243456	10284870	10329781	10378260	29
32	10244118	10285589	10330559	10379098	28
33	10244782	10286310	10331339	10379938	27
34	10245445	10287032	10332119	10380778	26
35	10246110	10287754	10332902	10381620	25
36	10246776	10288478	10333684	10382463	24
37	10247442	10289202	10334467	10383307	23
38	10248110	10289928	10335252	10384153	22
39	10248778	10290654	10336037	10384999	21
40	10249448	10291381	10336804	10385846	20
41	10250119	10292109	10337612	10386694	19
42	10250790	10292838	10338400	10387543	18
43	10251461	10293569	10339189	10388393	17
44	10252136	10294300	10339980	10389244	16
45	10252811	10295034	10340771	10390096	15
46	10253484	10295766	10341564	10390949	14
47	10254162	10296501	10342357	10391803	13
48	10254839	10297237	10343152	10392657	12
49	10255517	10297973	10343947	10393513	11
50	10256196	10298710	10344743	10394370	10
51	10256876	10299446	10345541	10395228	9
52	10257557	10300188	10246340	10396087	8
53	10258239	10300928	10347139	10396947	7
54	10258922	10301669	10347940	10397808	6
55	10259606	10392411	10348741	10398670	5
56	10260291	10303154	10349544	10399533	4
57	10260977	10303898	10350347	10400397	3
58	10261664	10304643	10351151	10401262	2
59	10262351	10305390	10351956	10402120	1
60	10263040	10306136	10352762	10402994	0
	77	76	75	74	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	16	17	18	19	
0	10402994	10456917	10514621	10576207	60
1	10403862	10457847	10515616	10577267	59
2	10404730	10458779	10516612	10578328	58
3	10405665	10459711	10517609	10579390	57
4	10406471	10460641	10518607	10580453	56
5	10407343	10461580	10519606	10581518	55
6	10408216	10462516	10520606	10582582	54
7	10409091	10463455	10521607	10583650	53
8	10409966	10464391	10522608	10584717	52
9	10410843	10465330	10523611	10585785	51
10	10411721	10466270	10524615	10586855	50
11	10412660	10467211	10525620	10587925	49
12	1041[illegible]479	10468153	1052[illegible]626	10588997	48
13	10414380	10469099	10527633	10590070	47
14	10415241	10470041	10528642	10591145	46
15	10416124	10470986	10529651	10592220	45
16	10417007	10471933	10530662	10593297	44
17	10417892	10472880	10531673	10594375	43
18	10418778	10473829	10532686	10595455	42
19	10419665	10474778	10533699	10596534	41
20	10420553	10475729	10534714	10597615	40
21	10421442	10476680	10535730	10598697	39
22	10422333	10477633	10536747	10599780	38
23	10423224	10478587	10537765	10600865	37
24	10424116	10479542	10538785	10601950	36
25	10425009	10480498	10539805	10603037	35
26	10425903	10481454	10540826	10604125	34
27	10426798	10482412	10541848	10605214	33
28	10427694	10484371	10542872	10606304	32
29	10428591	10484331	10543897	10607395	31
30	10429489	10485292	10544921	10608487	30
	73	72	71	70	

The minutes of deg. of the Quadrant for the Secants of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

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of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	16	17	18	19	
30	10429489	10485292	10544923	10608487	30
31	10430388	10486254	10545950	10609580	29
32	10431288	10487217	10546977	10610675	28
33	10432189	10488181	10548006	10611770	27
34	10433091	10489146	10549036	10612867	26
35	10433995	10490113	10550067	10613964	25
36	10434899	10491080	10551099	10625063	24
37	10435805	10492049	10552135	10616163	23
38	10436711	10493018	10553168	10617264	22
39	10437619	10493989	10554204	10618366	21
40	10438528	10494961	10555241	10619469	20
41	10439436	10495934	10556279	10620574	19
42	10440346	10496908	10557318	10621680	18
43	10441257	10497883	10558359	10622787	17
44	10442170	10498859	10559400	10623895	16
45	10443083	10499836	10560443	10625004	15
46	10443998	10500814	10561486	10626114	14
47	10444913	10501793	10562531	10627226	13
48	10445830	10502773	10563577	10628338	12
49	10446749	10503754	10564623	10629451	11
50	10447668	10504736	10565670	10630566	10
51	1044[illegible]858	10505719	10566719	10631682	9
52	104[illegible]950	10506704	10567769	10632799	8
53	1045[illegible]431	10507689	10568820	10633917	7
54	10451354	10508676	10569872	10635037	6
55	10452279	10509664	10570925	10636157	5
56	10453204	10510653	10571980	10637279	4
57	10454131	10511643	10573034	10038402	3
58	10455058	10512635	10574091	10639526	2
59	10455987	10513627	10575149	10640651	1
60	10456917	10514621	10576207	10641777	0
	73	72	71	70	

The minutes of deg. of the Quadrant for the Secants of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	20	21	22	23	
0	10641777	10711449	10785347	10863603	60
1	10642905	10712646	10786616	10864945	59
2	10644024	10712844	10787885	10866289	58
3	10645164	10715042	10789155	10867633	57
4	10646295	10716242	10790427	10868979	56
5	10647427	10717444	10791700	10870326	55
6	10648560	10718647	10792974	10871675	54
7	10649694	10719850	10794250	10873024	53
8	10650829	10721056	10795527	10874374	52
9	10651965	10722261	10796805	10875726	51
10	10653103	10723469	10798085	10877079	50
11	10664242	10724677	10799365	10878434	49
12	10655381	10725887	10800647	10879790	48
13	10656522	10727098	10801930	10881147	47
14	10657664	10728310	10803214	10882506	46
15	10658807	10720524	10804503	10883865	45
16	10659951	10730738	10805784	10885226	44
17	10661097	10731953	10807074	10886588	43
18	10662244	10733170	10808369	10887952	42
19	10663392	10734387	10809652	10889317	41
20	10664541	10735606	10810942	10890683	40
21	10665692	10736826	10812234	10892051	39
22	10666844	10738048	10813528	10893417	38
23	10667996	10739270	10814823	10894788	37
24	10669150	10740494	10816119	10896159	36
25	10670304	10741719	10817417	10897531	35
26	10671460	10742945	10818715	10898905	34
27	10672617	10744173	10820015	10900286	33
28	10673776	10745401	10821316	10901656	32
29	10674936	10746631	10822617	10903033	31
30	10676096	10747864	10823920	10905413	30
	69	68	67	66	

The minutes of deg. of the Quadrant for the Secants of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	20	21	22	23	
30	10676096	10747864	10823920	10904413	30
31	10677258	10749094	10825225	10905790	29
32	10678420	10750327	10826531	10907171	28
33	10679584	10751561	10827838	10908553	27
34	10680749	10752797	10829146	10909936	26
35	10681915	10754034	10830455	10911322	25
36	10683082	10755273	10831766	10912709	24
37	10684250	10756513	10833078	10914096	23
38	10685420	10757753	10834391	10915484	22
39	10686519	10758995	10835706	10916874	21
40	10687763	10760237	10837023	10918265	20
41	10688936	10761481	10838341	10919657	19
42	10690111	10762726	10839660	10921051	18
43	10691287	10763972	10840980	10922446	17
44	10692464	10765220	10842301	10923844	16
45	10693642	10766469	10843623	10925241	15
46	10694821	10767720	10844947	10926641	14
47	10696001	10768971	10846272	10928041	13
48	10667182	10770224	10847597	10929442	12
49	10698364	10771477	10848924	10930846	11
50	10699548	10772732	10850252	10932249	10
51	10700732	10773988	10851583	10933654	9
52	10701918	10775244	10852914	10935061	8
53	10703105	10776502	10854246	10936469	7
54	10704294	10777761	10855578	10937879	6
55	10705483	10779022	10856912	10939290	5
56	10706674	10780284	10858247	10940702	4
57	10707866	10781547	10859584	10942115	3
58	10709059	10782812	10860922	10943527	2
59	10710254	10784078	10862262	10944945	1
60	10711449	10785347	10863603	10946362	0
	69	68	67	66	

The minutes of deg. of the Quadrant for the Secants of the coplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	24	25	26	27	
0	10946362	11033783	11126020	11222262	60
1	10947781	11035280	11127601	11224927	59
2	10949201	11036779	11129182	11226593	58
3	10950622	11038279	11130765	11228260	57
4	10952045	11039780	11132349	11229929	56
5	10953469	11041283	11133933	11231599	55
6	10954895	11042787	11135519	11233270	54
7	10956320	11044293	11137106	11234943	53
8	10957747	11045799	11138694	11236617	52
9	10959175	11047306	11140284	11238292	51
10	10960605	11048815	11141875	11239969	50
11	10962036	11050325	11143467	11241648	49
12	10963469	11051837	11145061	11243329	48
13	10964963	11053350	11146656	11245011	47
14	10966338	11054865	11148254	11246694	46
15	10967775	11056381	11149853	11248378	45
16	10969213	11057898	11151453	11250064	44
17	10970652	11059420	11153055	11251751	43
18	10972091	11060939	11154658	11253440	42
19	10973533	11062461	11156262	11255130	41
20	10974976	11063985	11157868	11256822	40
21	10976420	11065506	11159475	11258516	39
22	10977865	11067034	11161084	11260211	38
23	10979312	11068560	11162694	11261907	37
24	10980760	11070990	11164306	11263605	36
25	10982210	11071621	11165919	11265304	35
26	10983661	11073152	11167533	11267005	34
27	10985113	11074684	11169149	11268707	33
28	10986567	11076218	11170766	11270410	32
29	10988022	11077753	11172385	11272114	31
30	10989480	11079289	11174004	11273820	30
	65	64	63	62	

The minutes of deg. of the Quadrant for the Secants of the coplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	24	25	26	27	
30	10978480	11079289	11174004	11273820	30
31	10990938	11080827	11175627	11275528	29
32	10992398	11082366	11177246	11277238	28
33	10993857	11083906	11178873	11278949	27
34	10995318	11085448	11180499	11280661	26
35	10996780	11086990	11182125	11282374	25
36	10998244	11088536	11183752	11284089	24
37	10999710	11090082	11185583	11285805	23
38	11001176	11091620	11187014	11287524	22
39	11002947	11093178	11188647	11289244	21
40	11004116	11094729	11190281	11290965	20
41	11005587	11096280	11191916	11292688	19
42	11007059	11097833	11193553	11294412	18
43	11008533	11099387	11195191	11296135	17
44	11010008	11100943	11196831	11297864	16
45	11011484	11102500	11198472	11299593	15
46	11012960	11104058	11200114	11301324	14
47	11014438	11105617	11201758	11303056	13
48	11015920	11107179	11203404	11304789	12
49	11017400	11108741	11205051	11306523	11
50	11018880	11110306	11206700	11308259	10
51	11020367	11111871	11208350	11309996	9
52	11021852	11113438	11210001	11311735	8
53	11023338	11115006	11211654	11313476	7
54	11024826	11116575	11212308	11315218	6
55	11026315	11118145	11214963	11316961	5
56	11027806	11119717	11216620	11318706	4
57	11029298	11121290	11218278	11320452	3
58	11010791	11122865	11219938	11222199	2
59	11032287	11124442	11211599	11323949	
60	11033783	11126020	11222262	11325700	0
	65	64	63	62	

The minutes of deg. of the Quadrant for the Secants of the coplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	28	29	30	31	
0	11325700	11433540	11547004	11666331	60
1	11327452	11435384	11548944	11668371	59
2	11329206	11437220	11550886	11670413	58
3	11330961	11439078	11552829	11672457	57
4	11332718	11440927	11554774	11674502	56
5	11334479	11442777	11556720	11676548	55
6	11336237	11444629	11558669	11678597	54
7	11337999	11446483	11560619	11680647	53
8	11339762	11449239	11562570	11682698	52
9	11341526	11450196	11564523	11684752	51
10	11343292	11452054	11566480	11686807	50
11	11345060	11453915	11568434	11688864	49
12	11346830	11455776	11570393	11690922	48
13	11348601	11457639	11571353	11692984	47
14	11350373	11459503	11574314	11695046	46
15	11351146	11461370	11576277	11697110	45
16	11353923	11463228	11578242	11699176	44
17	11355698	11465107	11580208	11701243	43
18	11357475	11466978	11582175	11703312	42
19	11359255	11468850	11584145	11705383	41
20	11361036	11470723	11586116	11707455	40
21	11362819	11472599	11588089	11709530	39
22	11364603	11474480	11590064	11711606	38
23	11366389	11476354	11592040	11713684	37
24	11368177	11478235	11594018	11715764	36
25	11369966	11480117	11595998	11717845	35
26	11371756	11482001	11597979	11719928	34
27	11373548	11483887	11599961	11722012	33
28	11375341	11485774	11601946	11724099	32
29	11377136	11487662	11603932	11726187	31
30	11378933	11489553	11605910	11728276	30
	61	60	59	58	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	28	29	30	31	
30	11378933	11489553	11605919	11728276	30
31	11380731	11491445	11607909	11730367	29
32	11382530	11493338	11609900	11732460	28
33	11384331	11495233	11611893	11734555	27
34	11386134	11497140	11613888	11736652	26
35	11387938	11499028	11615886	11738751	25
36	11389744	11500928	11617882	11740851	24
37	11391551	11502829	11019881	11742953	13
38	11393359	11504721	11621882	11745057	22
39	11395169	11506636	11623885	11747162	21
40	11396981	11508542	11625889	11749269	20
41	11398794	11510450	11627896	11751378	19
42	11400609	11512360	11629904	11753489	18
43	11402425	11514271	11631913	11755603	17
44	11404243	11516183	11633924	11757718	16
45	11406063	11518097	11635937	11759834	15
46	11407884	11520013	11637952	11761951	14
47	11409706	11521930	11639968	11764069	13
48	11411530	11523849	11641986	11766190	12
49	11413356	11525770	11644005	11768312	11
50	11415183	11527692	11646026	11770437	10
51	11417012	11529616	11048049	11772564	9
52	11418842	11531542	11650075	11774696	8
53	11420673	11533469	11652099	11776822	7
54	11422507	11535398	11654127	11778954	6
55	11424342	11537328	11656156	11781088	5
56	11426178	11539260	11658188	11783223	4
57	11428016	11541193	11660221	11785361	3
58	11429856	11543128	11660256	11787500	2
59	11431699	11545065	11664292	11789640	1
60	11433540	11547004	11666331	11791783	0
	61	60	59	58	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	32	33	34	35	
0	11791783	11923633	12062179	12207745	60
1	11793927	11925886	12064546	12210233	59
2	11796073	11928141	12066916	12212723	58
3	11798221	11930397	12069286	12215214	57
4	11800371	11932656	12071660	12217706	56
5	11802522	11934917	12074036	12220204	55
6	11804675	11937180	12076413	12222702	54
7	11806830	11939445	12078792	12225201	53
8	11808987	11941711	12081174	12227703	52
9	11811155	11943979	12083558	12230207	51
10	11813306	11946250	12085943	12232713	50
11	11815468	11948522	12088330	12235221	49
12	11817632	11950796	12090720	12237732	48
13	11819797	11953071	12093111	12240245	47
14	11821965	11955349	12095504	12242759	46
15	11824134	11957629	12097877	1224527	45
16	11826306	11959910	12100296	12247794	44
17	11828479	11962194	12102696	12250315	43
18	11830654	11964479	12105097	12252837	42
19	11832830	11966766	12107500	12255361	41
20	11835008	11069055	12109905	12257888	40
21	11837188	11971346	12112312	12260417	39
22	11839269	11973638	12114722	12262948	38
23	11841552	11975932	12117133	12265481	37
24	11843737	11978229	12119546	12268016	36
25	11845924	11980527	12121960	12270553	35
26	11848114	11982828	12124377	12273093	34
27	11850305	11985131	12126796	12275634	33
28	11852498	11987435	12129216	12278177	32
29	11854693	11989741	12131638	12280722	31
30	11856890	11992050	12134063	12283270	30
	57	56	55	54	

The minutes of deg. of the Quadrant for the Secants of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants.

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	32	33	34	35	
30	11850890	11992050	12134063	12283270	30
31	11859088	11994360	12136490	12285820	29
32	11861288	11996672	12138919	12288372	28
33	11863489	11998986	12141350	12290925	27
34	11865693	12001303	12143783	12293481	26
35	11867899	12003619	12146218	12296039	25
36	11870107	12005938	12148656	12298599	24
37	11872316	12008259	12151095	12301161	23
38	11874527	12010582	12153536	12303725	22
39	11876739	12012907	12155978	12306291	21
40	11878954	12015233	12158423	12308859	20
41	11881171	12017562	12160870	12311430	19
42	11883389	12019893	12163319	12314003	18
43	11885609	12022226	12165770	12316578	17
44	11887831	12024560	12168223	12319156	16
45	11890054	12026897	12170677	12321736	15
46	11892280	12029236	12173135	12324317	14
47	11894508	12031576	12175594	12326900	13
48	11896737	12033919	12178055	12329486	12
49	11898968	12036264	12180518	12332074	11
50	11901202	12038610	12182983	12334664	10
51	11903437	12040958	12185450	12337256	9
52	11905674	12043309	12187919	12339851	8
53	11907912	12045661	12190390	12342448	7
54	11910153	12048016	12192864	12345046	6
55	1191239	12050372	12195340	12347646	5
56	11914640	12052720	12197817	12350249	4
57	11916886	12055089	12200296	12352854	3
58	1191913	12057451	12202777	12355460	2
59	11921382	12059814	12205260	12358068	1
60	1192363	12062179	12207745	12360678	0
	57	56	55	54	

The minutes of deg. of the Quadrant for the Secants of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	36	37	38	39	
0	12360678	12521357	12690184	12867599	60
1	12363290	12524103	12693074	12870632	59
2	12365906	12526851	12695957	12873667	58
3	12368524	12592601	12698847	12876734	57
4	12371144	12532354	12701739	12879744	56
5	12373766	12535110	12704634	12882787	55
6	12376391	12537867	12707521	12885832	54
7	12379018	12540627	12710430	12888879	53
8	12381647	12543389	12713332	12891929	52
9	12384278	12546152	12716236	12894982	51
10	12386911	12548918	12710142	12898035	50
11	12389546	12551686	12722052	12901094	49
12	12392183	12554456	12724964	12904155	48
13	12394822	12557229	12727878	12907218	47
14	12397464	12560005	12720794	12910283	46
15	12400108	12562783	12733713	12913351	45
16	12402754	12565563	12726635	12916422	44
17	12405402	12568345	12739559	12919494	43
18	12408053	12571130	12742485	12922569	42
19	12410705	12573917	12745413	12925647	41
20	12413359	12576706	12748344	12928727	40
21	12416015	12579497	12751277	12931809	39
22	12418674	12582292	12754213	12934895	38
23	12421335	12585087	12757151	12937983	37
24	12423998	12587885	12760092	12941073	36
25	12426663	12590685	12763035	12944166	35
26	12429331	12593488	12765981	12947262	34
27	12432001	12596293	12768929	12950360	33
28	12434673	12599101	12771880	12953461	32
29	12437348	12601911	12774833	12956565	31
30	12440024	12604724	12777788	12959671	30
	53	52	51	50	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	36	37	38	39	
30	12447024	12604724	12777788	12959671	30
31	12442701	12607539	12780746	12962780	29
32	12445383	12610356	12783707	12965892	28
33	12448066	12613175	12786670	12969007	27
34	12450751	12615997	12789635	12972124	26
35	12453438	12618821	12792602	12975243	25
36	12456128	12621648	12795573	12978366	24
37	12458821	12634477	12798546	12981491	23
38	12461516	12627308	12801521	12984618	22
39	12464213	12630141	12804498	12987747	21
40	12464213	12632977	12808478	12990880	20
41	12469614	12655815	12810460	12994015	19
42	12472217	12638755	12813445	12997153	18
43	12475022	12641497	12816432	13000293	17
44	12477720	12644343	12819422	13003436	16
45	12480440	12647191	12822415	13006582	15
46	12483152	12650041	12825410	13009730	14
47	12485866	12652893	12828407	13012881	13
48	12488582	12655748	12831407	13016034	12
49	12491302	12658605	12834409	13019189	11
50	12494022	12661494	12837414	13022348	10
51	12496743	12664325	12840421	13025509	9
52	12499469	12667189	12843431	13028673	8
53	12502197	12670050	12846443	13031839	7
54	12504927	12672924	12849458	13035008	6
55	12507659	12675795	12852475	13038180	5
56	12510394	12678668	12855495	13041354	4
57	12513132	12681543	12858517	13044530	3
58	12515871	12984421	12861542	13047710	2
59	12518613	12687301	12864569	13050892	1
60	12521357	12690184	12867599	13054077	0
	53	52	51	50	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	40	41	42	43	
0	13054077	13250131	13456326	13673275	60
1	13057264	13253482	13459851	13676986	59
2	13060455	13256835	13463380	13680700	58
3	13063646	13260192	13466912	13684417	57
4	13066843	13263552	13470447	13688128	56
5	13070042	13266915	13473985	13691861	55
6	13073242	13270282	13477527	13695587	54
7	13076445	13273651	13481071	13699316	53
8	13079651	13277023	13484618	13703048	52
9	13082859	13280397	13488168	13706783	51
10	13086071	13283775	13491721	13710523	50
11	13089285	13287155	13495267	13714266	49
12	13092502	13290538	13498835	13718012	48
13	13095721	13293924	13502397	13721761	47
14	13098944	13297313	13505962	13725514	46
15	13102169	13300704	13509530	13729270	45
16	13105397	13304098	13513101	13733029	44
17	13108627	13307495	13516675	13736790	43
18	13111861	13310896	13520252	13740555	42
19	13115098	13314299	13523832	13744322	41
20	13118337	13317705	1352741	13748092	40
21	13121578	13321114	13531003	13751867	39
22	13124823	13324526	13534593	13755644	38
23	13128070	13327941	13538185	13759424	37
24	13131320	13331359	13541781	13763209	36
25	13134572	13334779	13545380	13766997	35
26	13137828	13338203	13548981	13770788	34
27	13141085	13341629	13552585	13774582	33
28	13144346	13345058	13556193	13778380	32
29	13147609	13348490	13559803	13782181	31
30	13150874	13351924	135[illegible]417	13785985	30
	49	48	47	46	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	40	41	42	43	
30	13150874	13351924	13562417	13785085	30
31	13154142	13355361	13567034	13789792	29
32	13156413	13358802	13570954	13793603	28
33	13160687	13362245	13574277	13797416	27
34	13163964	13365691	13577903	13801233	26
35	13167243	13369140	13581532	13805053	25
36	13170526	13372592	13585164	13808876	24
37	13173811	13376047	13588799	13812703	23
38	13177099	13379505	13592438	13816534	22
39	13180389	13382966	13596079	13820368	21
40	13183682	13386430	13599723	13824205	20
41	13186978	13389897	13603370	13828045	19
42	13190276	13393367	13607021	13831889	18
43	13193577	13396839	13610675	13835736	17
44	13196882	13400315	13614331	13839586	16
45	13200189	13403794	13617992	13843439	15
46	13203499	13407275	13621656	13847296	14
47	13206812	13410759	13625323	13851156	13
48	13210128	13414247	13628993	13855019	12
49	13213447	13417738	13632066	13858885	11
50	13216769	13421232	13636342	13862755	10
51	13220093	13424728	13640021	13866628	9
52	13223421	13428227	13643704	13870505	8
53	13226750	13431729	13647390	13874385	7
54	13230082	13435234	13651078	13878268	6
55	13233417	13438742	13654769	13882154	5
56	13236754	13442253	13658464	13886044	4
57	13240094	13445767	13962162	13889936	3
58	13243437	13439184	13665863	13893833	2
59	13246783	13452804	13669567	13897733	1
60	13250121	13456326	13673275	13901636	0
	49	48	47	46	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	44	45	46	47	
0	13901636	14142135	14395564	14662790	60
1	13905542	14146251	14399901	14667366	59
2	13909451	14190371	14404242	14671946	58
3	13913365	14154494	14408587	14676530	57
4	13917281	14158621	14412937	14681119	56
5	13921201	14162751	14417290	14685712	55
6	13925126	14166884	14421647	14690309	54
7	13929052	14171021	14426008	14694910	53
8	13932982	14175162	14430374	14699514	52
9	13936916	14179306	14434743	14704122	51
10	13940854	14183454	14439116	14708735	50
11	13944795	14187606	14443493	14713352	49
12	13948739	14191761	14447874	14717973	48
13	13952686	14195919	14452259	14722598	47
14	13956638	14200083	14456648	14727228	46
15	13960592	14204248	14461040	14731862	45
16	13964550	14208418	14465437	14736500	44
17	13968511	14212591	14469838	14741142	43
18	13972476	14216769	14474242	14745788	42
19	13976444	14220950	14478650	14750438	41
20	13980416	14225135	14483062	14755094	40
21	13984391	14229324	14487478	14759753	39
22	13988370	14233517	14491898	14764416	38
23	13992352	14237713	14496322	14769083	37
24	13996338	14241913	14500750	14773755	36
25	14000327	14246115	14505182	14778430	35
26	14004310	14250321	14509617	14783110	34
27	14008315	14254531	14514056	14787794	33
28	14012314	14258745	14518500	14792482	32
29	14016316	14262961	14522946	14797174	31
30	14020322	14267182	14527397	14801871	30
	45	44	43	42	

The minutes of deg. of the Quadrant for the Secants of the cõplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	44	45	46	47	
30	14020322	14267182	14527397	14801871	30
31	14024332	14271407	14531852	14806571	29
32	14028345	14275635	14536311	14811276	28
33	14032361	14279867	14540773	14815985	27
34	14036381	14284103	14545240	14820698	26
35	14040404	14288343	14540711	14825416	25
36	14044431	14292587	14554186	14830139	24
37	14048461	14296834	14558665	14834866	23
38	14052494	14301086	14563148	14839597	22
39	14056531	14305341	14567635	14844332	21
40	14060572	14309599	14572126	14849072	20
41	14064616	14313861	14576621	14853815	19
42	14068664	14318127	14581120	14858563	18
43	14072715	14322396	14585624	14863315	17
44	14076770	14326670	14590131	14868071	16
45	14080829	14330947	14594642	14872831	15
46	14084891	14335228	14599157	14877597	14
47	14088956	14339513	14603676	14882367	13
48	14093026	14343802	14608199	14887141	12
49	14097099	14348095	14612725	14891919	11
50	14101175	14352391	14617256	14896701	10
51	14105255	14356691	14621791	14901487	9
52	14109339	14360995	14626330	14906278	8
53	14113427	14365303	14630873	14911073	7
54	14117518	14369615	14635421	14915873	6
55	14121612	14373930	14639973	14920677	5
56	14125709	14378250	14644528	14925486	4
57	14129810	14382673	14649087	14930299	3
58	14133915	14386900	14653651	14935116	2
59	14138023	14391230	14658218	14939936	1
60	14142135	14395564	14662790	14944764	0
	45	44	43	42	

The minutes of deg. of the Quadrant for the Secants of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	48	49	50	51	
0	14944764	15242532	15557239	15890158	60
1	14949594	15247634	15562635	15895869	59
2	14954429	15252741	15568036	15901586	58
3	14959268	15257852	15573441	15907307	57
4	14964112	15262969	15578852	15913034	56
5	14968960	15268090	15584267	15918766	55
6	64973812	15273216	15589688	15924504	54
7	14978668	15278347	15595114	15930247	53
8	14983530	15283484	15600545	15935995	52
9	14988396	15288626	15605981	15941748	51
10	14993266	15293773	15611422	15947508	50
11	14998140	15298924	15616868	15953273	49
12	15003020	15304080	15622319	15959044	48
13	15007903	15309240	15627775	15964820	47
14	15012791	15314405	15633237	15970603	46
15	15017683	15319574	15638704	15976390	45
16	15022580	15324748	15644177	15982184	44
17	15027481	15329926	15649655	15987982	43
18	15032387	15335109	15655138	15993788	42
19	15037297	15340297	15660626	15999599	41
20	15042212	15345491	15666119	16005416	40
21	15047131	15350689	15671617	16011237	39
22	15052054	15355893	15677121	16017065	38
23	15056982	15361100	15682630	16022898	37
24	15061915	15366313	15688144	16028736	36
25	15066852	15371530	15693663	16034579	35
26	15071791	15376752	15699188	16040429	34
27	15076739	15381980	15704717	16046283	33
28	15081690	15387212	15710252	16052143	32
29	15086645	15392449	15715791	16058008	31
30	15091605	15397692	15721337	16063878	30
	41	40	39	38	

The minutes of deg. of the Quadrant for the Secants of the coplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	48	49	50	51	
30	15091605	15397682	15721337	16063878	30
31	15096569	15402939	15726887	16069754	29
32	15101538	15408191	15730443	16075627	28
33	15106511	15413447	15738003	16081524	27
34	15111490	15418708	15743569	16087418	26
35	15116472	15423974	15749141	16093318	25
36	15121459	15429246	15754718	16099224	24
37	15126451	15434522	15760300	16105135	23
38	15131447	15439803	15765889	16111053	22
39	15136447	15445089	15771479	16116976	21
40	15141452	15450380	15777077	16122905	20
41	15146462	15455675	15782680	16128839	19
42	15151478	15460976	15788289	16134779	18
43	15156497	15466282	15793903	16140724	17
44	15161520	15471593	15799523	16146676	16
45	15166548	15476908	15805147	16152634	15
46	15171581	15482229	15810777	16158598	14
47	15176619	15487554	15816412	16164567	13
48	15181661	15492885	15822052	16170542	12
49	15186708	15498220	15827697	16176522	11
50	15191760	15503560	15833349	16182509	10
51	15196816	15508905	15839005	16188501	9
52	15201877	15514256	15844669	16194499	8
53	15206943	15519611	15850335	16200503	7
54	15212013	15524972	15856008	16206513	6
55	15217088	15530338	15861686	16212528	5
56	15222168	15535710	15867370	16218550	4
57	15227253	15541083	15873058	16224577	3
58	15232342	15546463	15878753	16230610	2
59	15237435	15551848	15884453	16236648	1
60	15242532	15557239	15890158	16242692	0
	41	40	39	38	

The minutes of deg. of the Quadrant for the Secants of the coplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	52	53	54	55	
0	10624692	16616402	17013017	17434469	60
1	16248742	16622819	17019832	17441715	59
2	16254799	16629243	17026654	17448968	58
3	16260861	16635673	17033482	17456229	57
4	16266929	16642109	17040318	17463499	56
5	16273003	16648551	17047160	17470775	55
6	16279083	16655001	17054010	17478059	54
7	10285169	16661457	17060866	17485351	53
8	16291261	16667919	17067729	17492690	52
9	16297389	16674388	17074599	17499957	51
10	16303461	16680864	17081476	17507272	50
11	16309570	16687345	17088359	17514599	49
12	16315685	16693835	17095250	17521924	48
13	16321806	16700328	17102149	17529262	47
14	16327934	16706829	17109056	17536607	46
15	16334067	16713336	17115968	17543959	45
16	16340207	16719850	17122888	17551319	44
17	16346353	16726372	17129816	17558687	43
18	16352505	16732897	17136747	17566063	42
19	16358663	16739430	17143689	17573440	41
20	16364827	16745970	17150629	17580837	40
21	16370996	16752517	17157593	17588236	39
22	16377172	16759070	17164550	17595643	38
23	16383359	16765629	17171525	17603057	37
24	16389542	16772195	17178502	17610480	36
25	16395736	16778767	17185485	17617909	35
26	16401936	16785347	17192476	17625347	34
27	16408142	16791939	17199472	17632793	33
28	16414355	16798525	17206477	17640246	32
29	16420573	16805124	17213488	17647707	31
30	16426798	16811729	17220507	17655174	30
	37	36	35	34	

The minutes of deg. of the Quadrant for the Secants of the coplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	52	53	54	55	
30	16426798	16811729	17220507	17655175	30
31	16433027	16818341	17227532	17662651	29
32	16439263	16824960	17234565	17670136	28
33	16445505	16831585	17241605	17677627	27
34	16451754	16838217	17248653	17685127	26
35	16458008	16844856	17255708	17692635	25
36	16464269	16851502	17262770	17700151	24
37	16470536	16858154	17269839	17707674	13
38	16476809	16864813	17276917	17715206	22
39	16483089	16871479	17284002	17722744	21
40	16489375	16878151	17291095	17730290	20
41	16495668	16884830	17298194	17737844	19
42	16501967	16891515	17305300	17745407	18
43	16508272	16898207	17312413	17752978	17
44	16514582	16904907	17319534	17760555	16
45	16520898	16911613	17326662	17768142	15
46	16527220	16918326	17333798	17775740	14
47	16533548	16925046	17340941	17783343	13
48	16539883	16931772	17348091	17790955	12
49	16546224	16938504	17355249	17798575	11
50	16552571	16945244	17362415	17806203	10
51	16558925	16951990	17369587	17813838	9
52	16565286	16958743	17376767	17821481	8
53	16571652	10965504	17383954	17829132	7
54	16578026	16972270	17391148	17836792	6
55	10584406	16979044	17398350	17844460	5
56	16590792	16985824	17405560	17852135	4
57	16597184	16992611	17412776	17859818	3
58	16603584	16999406	17420000	17867509	2
59	16609989	17006208	17427231	17875209	1
60	16616401	17013017	17434469	17882917	0
	37	36	35	34	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	56	57	58	59	
0	17882917	18360786	18870800	19416039	60
1	17890632	18369014	18879509	19425445	59
2	17898356	18377251	18888389	19434862	58
3	17906089	18385497	18897196	19444290	57
4	17913830	18393753	18906018	19453727	56
5	17921579	18402017	18914846	19463175	55
6	17929337	18410291	18923685	19472635	54
7	17937102	18418574	18932534	19482104	53
8	17944876	18426865	18941393	19491583	52
9	17952658	18435165	18950261	19501076	51
10	17960448	18443474	18959139	19510578	50
11	17968247	18451792	18968027	19520091	49
12	17976054	18460120	18976926	19529615	48
13	17983869	18468456	18985834	19539150	47
14	17991693	18476802	18994752	19548697	46
15	17999525	18485157	19003680	19558254	45
16	18007365	18493521	19012618	19567822	44
17	18015214	18501895	19021566	19577401	43
18	18023071	18510278	19030523	19586991	42
19	18030936	18518670	19039491	19595592	41
20	18038811	18527072	19048468	19606204	40
21	18046693	18535482	19057455	19615827	39
22	18054584	18543902	19066453	19625462	38
23	18062482	18552332	19075461	19635107	37
24	18070389	18560770	19084480	19644765	36
25	18078305	18569217	19093509	19654434	35
26	18086229	18577674	19102549	19664114	34
27	18094161	18586139	19111598	19673805	33
28	18102102	18594614	19120658	19683507	32
29	18110051	18603098	19129727	19693220	31
30	18118009	18611591	19138807	19702945	30
	33	32	31	30	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	56	57	58	59	
30	18118009	18611591	19138807	19702945	30
31	18125975	18620094	19147897	19712680	29
32	18133950	18628606	19156998	19722428	28
33	18141934	18637127	19166109	19732186	27
34	18149926	18645658	19175231	19741956	26
35	18157927	18654198	19184362	19751738	25
36	18165937	18662748	19193504	19761531	24
37	18173956	18671307	19202656	19771335	23
38	18181984	18679875	19211818	19781141	22
39	18190021	18688452	19220990	19790968	21
40	18198065	18697038	19230172	19800808	20
41	18206118	18705634	19239365	19810658	19
42	18214179	18714239	19248569	19820520	18
43	18222249	18722854	19257783	19830393	17
44	18230328	18731480	19267008	19840277	16
45	18238416	18740115	19276242	19850172	15
46	18246512	18748760	19285488	19860079	14
47	18254618	18757414	19294744	19869997	13
48	18262732	18766078	19304010	19879927	12
49	18270854	18774752	19313287	19889868	11
50	18278986	18783436	19322574	19899820	10
51	18287126	18792130	19331872	19909784	9
52	18295276	18800833	19341181	19919760	8
53	18303434	18809546	19350501	19929748	7
54	18311601	18818268	19359831	19939749	6
55	18319776	18826999	19369172	19949760	5
56	18327961	18835741	19378524	19959784	4
57	18336154	18844492	19387886	19969820	3
58	18344356	18853252	19397260	19979868	2
59	18352567	18862021	19406644	19989928	1
60	18360786	18870800	19416939	20000000	0
	33	32	31	30	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	60	61	62	63	
0	20000000	20626654	21300545	22026892	60
1	20010083	20637484	21312206	22039475	59
2	20020176	20648328	21323882	22052074	58
3	20030285	20659184	21335570	22064690	57
4	20040404	20670054	21347275	22077322	56
5	20050534	20680937	21358993	22089970	55
6	20060676	20691834	21370727	22102635	54
7	20070832	20702744	31382475	22115316	53
8	20080995	20713667	21394238	22128014	52
9	20091172	20724603	21406016	22140728	51
10	20101361	20735554	21417808	22153459	50
11	20111562	20746517	21429615	22166204	49
12	20121776	20757494	21441438	22178971	48
13	20132001	20768484	21453275	22191751	47
14	20142239	20779488	21465128	22204548	46
15	20152489	20790505	21476995	22217361	45
16	20162751	20801535	21488877	22230191	44
17	20173035	20812579	21500774	22243038	43
18	20183321	20823636	21512686	22255902	42
19	20193619	20834706	21524612	22268782	41
20	20203930	20845791	21536552	22281680	40
21	20214252	20856888	21548509	22294595	39
22	20224588	20868000	21560481	22307526	38
23	20234936	20879125	21572467	22320474	37
24	20245296	20890264	21584469	22333439	36
25	20255669	20901416	21596487	22346420	35
26	20266054	20912582	21608520	22350419	34
27	20276452	20923761	21620568	22372434	33
28	20286863	20934955	21632631	22385466	32
29	20297286	20946162	21644710	22398517	31
30	20307721	20957383	21656804	22411584	30
	29	28	27	26	

The minutes of deg. of the Quadrant for the Secants of the cõplements of the arches of the ſame Quadrant

The degrees of the Quadrant for the Secants

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of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	60	61	62	63	
30	20307721	20957383	21656804	22411584	30
31	20318170	20968618	21668913	22424667	29
32	20328620	20979867	21681038	22437768	28
33	20339102	20991130	21693178	22450886	27
34	20349587	21002406	21705334	22464022	26
35	20360084	21013696	21717505	22477175	25
36	20370594	21025001	21729691	22490346	24
37	20381116	21036319	21741893	22503535	23
38	20391651	21047651	21754111	22516738	22
39	20402198	21058997	21766344	22529965	21
40	20412758	21070357	21778593	22543201	20
41	20423331	21081731	21790858	22556458	19
42	20433916	21093119	21803138	22569733	18
43	20444514	21104522	21815434	22583025	17
44	20455126	21115938	21827745	22596336	16
45	20465750	21127368	21840072	22609663	15
46	20476387	21138814	21852415	22623009	14
47	20487037	21150273	21864774	22636372	13
48	20497700	21161747	21877149	22649754	12
49	20508376	21173235	21889539	22663152	11
50	20519064	21184737	21901946	22676569	10
51	20529765	21196253	21914369	22690004	9
52	20540479	21207783	21926808	22703456	8
53	20551205	21219328	21939263	22716924	7
54	20561945	21230887	21951724	22730414	6
55	20572697	21242460	21964220	22743919	5
56	20583463	21254048	21976722	22757443	4
57	20594242	21265650	21989240	22770984	3
58	20605033	21277267	22001775	22784543	2
59	20615837	21288899	22014325	22798120	1
60	20626654	21300545	22026892	22811723	0
	29	28	27	26	

The minutes of deg. of the Quadrant for the Secants of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	64	65	66	67	
0	22811723	23662013	24585936	25593051	60
1	22825339	23676784	24602010	25610602	59
2	22838962	23691575	24618107	25628180	58
3	22852612	23706387	24634227	25645783	57
4	22866281	23721220	24650370	25663414	56
5	22879968	23736073	24666536	25681071	55
6	22893674	23750947	24682727	25698754	54
7	22907406	23765842	24698940	25716464	53
8	22921140	23780757	24715178	25734201	52
9	22934901	23795692	24731439	25751965	51
10	22948680	23810648	24747724	25769755	50
11	22962470	23825625	24764033	25787572	49
12	22976294	23840623	24780365	25805417	48
13	22990129	23855642	24796721	25823287	47
14	23003983	23870683	24813101	25841185	46
15	23017855	23885744	24829504	25859104	45
16	23031747	23900827	24845932	25877061	44
17	23045657	23915931	24862383	25895040	43
18	23059586	23931055	24878858	25913046	42
19	23073534	23946200	24895356	25931080	41
20	23087501	23961366	24911878	25949140	40
21	23101486	23976553	24928423	25967230	39
22	23115490	23991762	24944993	25985345	38
23	23129513	24006992	24961587	26003487	37
24	23143556	24022245	24978205	26021658	36
25	23157616	24037518	24994847	26039855	35
26	23171696	24052854	25011514	26058081	34
27	23185795	24068130	25028205	26076333	33
28	23199913	24083469	25044920	26094614	32
29	23214050	24098830	25061660	26112923	31
30	23228205	24114213	25078426	26131259	30
	25	24	23	22	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	64	65	66	67	
30	23228205	24114213	25078426	26131259	30
31	23222380	24129616	25095216	26149623	29
32	23205574	24145041	25112030	26168015	28
33	23270797	24160487	25128869	26186436	27
34	23285021	24175956	25145732	26204884	26
35	23299273	24191445	25162620	26223361	25
36	23313546	24206956	25179532	26241867	24
37	23327838	24222488	25196469	26260400	13
38	23342150	24238043	25213432	26278963	22
39	23356481	24253619	25230424	26297555	21
40	23370832	24269217	25247438	26316176	20
41	23385203	24284842	25264478	26334825	19
42	23399593	24300486	25281541	26353503	18
43	23414003	24316152	25298630	26372209	17
44	23428433	24331845	25315744	26390945	16
45	23442882	24347556	25332884	26409709	15
46	23457351	24363286	25350049	26428502	14
47	23471840	24379045	25367239	26447323	13
48	23486348	24394818	25384455	26466174	12
49	23500876	24410620	25401694	26485053	11
50	23515424	24426446	25418961	26503961	10
51	23529992	24442294	25436250	26502900	9
52	23544580	24458164	25453570	26541867	8
53	23559188	24474056	25470915	26560863	7
54	23573817	24489973	25488286	26579889	6
55	23588465	24505908	25505683	26598945	5
56	23603134	24521869	25523105	26618030	4
57	23617822	24537851	25540553	26637145	3
58	23632522	24553857	25558027	26656291	2
59	23647262	24569885	25575529	26675466	1
60	23662013	24585936	25593051	26694672	0
	25	24	23	22	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	68	69	70	71	
0	26694672	27904284	29238145	30715531	60
1	26713907	27925445	29261435	30741500	59
2	26733172	27946643	29284861	30767516	58
3	26752467	27967873	29308328	30793589	57
4	26771791	27989139	29331835	30819699	56
5	26791145	28010440	29355382	30845856	55
6	26810529	28031776	29378970	30872061	54
7	26829942	28053147	29402499	30898314	53
8	26849390	28074553	29426260	30924615	52
9	26868867	28095994	29449978	30950963	51
10	26888373	28117469	29473729	30977360	50
11	26907010	28138980	29497519	31003799	49
12	26927479	28160527	29521350	31030295	48
13	26947078	28182108	29545222	31056834	47
14	26966709	28203725	29569136	31083422	46
15	26986370	28225378	29593090	31110057	45
16	27006062	28247067	29617087	31136741	44
17	27025985	28268793	29641324	31163472	43
18	27045539	28290553	29665204	31190251	42
19	27065323	28312349	29689326	31217079	41
20	27085138	28334181	29713488	31243955	40
21	27104985	28356049	29737992	31270881	39
22	27124864	28377954	29761938	31297858	38
23	27144774	28399894	29786227	31324883	37
24	27164717	28421871	29810558	31351958	36
25	27184692	28443884	29834931	31379082	35
26	27204696	28465934	29859347	31406257	34
27	27224734	28488021	29883805	31433482	33
28	27244804	28510144	299 8306	31460757	32
29	27264906	28532304	29932850	31488078	31
30	27285040	28554501	29957438	31515448	30
	21	20	19	18	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	68	69	70	71	
30	27285040	28554501	29957438	31515448	30
31	27305205	28576735	29982069	31542873	29
32	27325402	28599007	30006743	31570349	28
33	27345631	28621316	30031460	31597875	27
34	27365893	28643662	30056220	31625453	26
35	27386186	28666045	30081023	31653080	25
36	27406513	28688467	30105870	31680758	24
37	27426872	28710925	30130760	31708485	23
38	27447264	28733422	30155694	31736265	22
39	27467688	28755956	30180672	31764094	21
40	27488145	28778529	30205694	31791974	20
41	27508635	28801139	30230760	31819916	19
42	27529157	28823787	30255871	31847896	18
43	27549712	28846473	30281026	31875939	17
44	27570301	28869196	20306226	31904029	16
45	27590922	28891957	30331460	31932164	15
46	27611578	28914756	30356759	31960358	14
47	27632266	28937594	30382090	31988606	13
48	27652989	28960471	30407470	32016909	12
49	27673745	28983386	30432890	32045263	11
50	27694535	29006240	30458361	32073672	10
51	27715358	29029333	30483873	32102132	9
52	27736215	29052375	30509430	32130649	8
53	27757105	29075435	30535033	32159212	7
54	27778029	29098543	30560682	32187832	6
55	27798987	29121697	30586375	32216504	5
56	27819978	29144888	30612115	32245231	4
57	27841003	29168118	30637896	32274012	3
58	27862060	29191388	30663732	32302846	2
59	27883156	29214697	30689608	32331735	1
60	27904284	29238045	30715531	32360978	0
	21	20	19	18	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	72	73	74	75	
0	32360678	34203038	36279559	38637032	60
1	32389670	34235609	36316402	38679023	59
2	32418726	34268245	36353323	38721112	58
3	32447837	34300957	36390323	38763296	57
4	32477001	34333726	36427401	38805571	56
5	32506219	34366563	36464548	38847941	55
6	32535494	34399462	36501783	38890408	54
7	32564823	34432430	36539097	38932971	53
8	32594209	34465466	36576491	38975632	52
9	32623651	34498567	36613963	39018390	51
10	32653148	34531736	36651518	39061246	50
11	32682701	34564969	36689156	39104200	49
12	32712311	34598269	36700868	39147252	48
13	32741977	34631636	36764660	39190403	47
14	32771699	34665071	36802533	39233653	46
15	32801478	34698574	36840488	39377002	45
16	32831314	34732145	36878524	39320449	44
17	32861207	34765785	36916651	39363994	43
18	32891157	34799493	36954852	39407640	42
19	32921165	34833269	36993137	39451384	41
20	32951231	34867105	37031596	39495228	40
21	32981355	34901024	37069957	39539172	39
22	33011537	34935005	37108489	39583218	38
23	33041776	34969052	37145101	39627364	37
24	33072074	35003172	37185803	39671613	36
25	33102431	35037361	37224589	39715975	35
26	33132846	35071621	37263459	39760430	34
27	33163320	35105952	37302413	39804989	33
28	33193850	35140354	37341443	39849652	32
29	33224444	35174826	37380567	39894421	31
30	33255094	35209369	37419778	39939296	30
	17	16	15	14	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

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of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	72	73	74	75	
30	33255094	35209369	37419778	39939296	30
31	33285803	35243981	37459071	39984263	29
32	33316571	35278664	37498450	40029344	28
33	33347398	35313418	37537913	40074528	27
34	33378280	35348244	37577461	40119816	26
35	33409236	35383140	37617104	40155219	25
36	33440249	35418110	37656824	40210719	24
37	33471317	35453152	37696632	40256326	23
38	33502456	35488268	37736538	40302043	22
39	33533645	35523456	37776523	40347868	21
40	33564895	35558718	37816598	40393799	20
41	33596214	35594052	37856761	40439844	19
42	33627591	35629450	37897008	40485995	18
43	33659026	35664930	37937346	40532245	17
44	33690525	35700484	37977779	40578613	16
45	33722086	35736111	38018300	40625091	15
46	33753707	35771812	38058912	40671678	14
47	33785390	35807587	38099614	40718374	13
48	33817138	35843437	38140406	40765180	12
49	33848944	35879363	38181288	40812093	11
50	33880819	35915364	38222251	40859929	10
51	33912753	35951441	38263314	40906269	9
52	33944756	35987600	38304469	40953526	8
53	33976821	36023819	38345715	41000896	7
54	3400894	36060122	38387054	41048378	6
55	34041131	36096500	38428485	41095967	5
56	34073385	36132956	38470006	41143678	4
57	34105699	36169490	38511625	41191492	3
58	34138081	36206100	38553334	41239431	2
59	34170523	36242794	38595136	41247485	1
60	34203038	36279559	38637032	41335654	0
	17	16	15	14	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	76	77	78	79	
0	41335654	44454097	48097345	52408433	60
1	41383937	44510183	48163261	52486983	59
2	41432338	44566415	48229360	52565774	58
3	41480856	44622793	48295643	52644807	57
4	41529492	44679318	48362112	52724084	56
5	41578245	44735990	48428766	52803604	55
6	41627117	44792810	48495609	52883248	54
7	41676180	44849777	48562641	52963357	53
8	41725219	44906892	48629864	53043612	52
9	41774450	44964155	48697279	53124109	51
10	41823802	45021567	48764897	53204860	50
11	41873273	45079129	48832708	53285864	49
12	41922863	45136843	48900813	53367114	48
13	41972573	45194707	48969013	53448625	47
14	42022405	45252726	49037409	53530380	46
15	42072357	45310898	49105840	53612399	45
16	42122431	45369223	49174617	53694666	44
17	42172625	45427703	49243590	53777191	43
18	42222942	45486338	49312751	53859976	42
19	42273380	45545127	49382118	53943022	41
20	42323942	45604073	49451684	54026331	40
21	42374637	45663185	49521449	54109903	39
22	42425459	45722445	49591416	54193729	38
23	42476402	45781863	49661584	54277840	37
24	42527472	45841489	49731956	54362207	36
25	42578675	45901174	49802532	54446832	35
26	42629997	45961069	49873313	54531734	34
27	42681449	46021125	49944301	54616905	33
28	42733029	46081343	50015497	54702346	32
29	42784735	46141725	50086901	54788058	31
30	42836576	46202261	50158514	54874053	30
	13	12	11	10	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	76	77	78	79	
30	42836576	46202261	50158514	54874053	30
31	42888543	46262909	50230335	54960312	29
32	42940641	46323841	50302367	55046847	28
33	42992865	46384367	50374610	55133659	27
34	43045229	46446066	50447065	55220751	26
35	43097722	46507427	50519732	55308122	25
36	43150247	46568596	50592614	55395785	24
37	43203103	46630655	50665711	55483726	23
38	43255992	46692517	50739024	55571950	22
39	43309012	46754545	50812543	55660454	21
40	43362166	46816748	50886299	55749256	20
41	43415454	46879117	50960253	55838340	19
42	43468877	46041660	51034437	55927706	18
43	43522435	47004371	51108840	56017380	17
44	43576129	47067252	51183465	56107347	16
45	43629959	47130312	51258311	56197599	15
46	43683925	47193542	51333381	56288149	14
47	43738728	47256945	51408684	56378993	13
48	43792268	47320519	51484204	56470197	12
49	43846640	47384274	51559951	56561588	11
50	43901162	47448295	51635926	56653392	10
51	43955817	47512312	51712129	56745380	9
52	44010612	47576596	51788563	56837733	8
53	44065548	47641058	51865227	56930392	7
54	44120625	47705699	51942124	57023269	6
55	44175844	47770520	52019254	57116633	5
56	44231207	47835521	52096618	57210226	4
57	44286712	47900699	52274216	57304120	3
58	44342262	47966068	52252051	57398357	2
59	44398156	48031615	52330123	57492866	1
60	44454097	48097345	52408433	57587706	0
	13	12	11	10	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	80	81	82	83	
0	57587706	63924545	71852975	82055127	60
1	57682861	64042158	72002606	82249986	59
2	57778351	64160190	72151659	82445779	58
3	57874150	64278683	72301941	82642513	57
4	57970282	64397652	72451863	82840196	56
5	58066738	64517048	72604421	83038833	55
6	58163510	64636899	72756618	83238436	54
7	58260619	64757198	72909461	83439009	53
8	58358049	64877938	73062954	83640561	52
9	58455820	64999144	73217100	83843097	51
10	58553923	65120789	73371903	84046616	50
11	58652353	65242926	73527367	84251153	49
12	58751129	65365518	73683499	84456680	48
13	58850235	65488586	73840302	84663212	47
14	58949683	65612099	73997781	84870760	46
15	59049474	65736099	74155942	85079327	45
16	59149611	65859675	74314786	85288957	44
17	59250095	65985531	74474318	85499628	43
18	59350928	66110967	74634544	85711347	42
19	59452092	66246886	74795468	85924121	41
20	59553628	66363291	74957095	86137958	40
21	59655506	66490185	75119429	86352864	39
22	59757738	66617572	75282475	86568849	38
23	59860326	66745453	75446238	86785921	37
24	59963271	66873831	75610721	87004089	36
25	60066582	67002708	75775928	87223362	35
26	60170255	67132088	75941864	87443750	34
27	60274286	67251972	76108533	87665261	33
28	60378680	67392365	76275941	87887909	32
29	60483442	67523270	76444091	88111704	31
30	60588585	67654691	76612989	88336657	30
	9	8	7	6	

The minutes of deg. of the Quadrant for the Secants of the cõplements of the arches of the ſame Quadrant

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	80	81	82	83	
30	60588585	67654691	76612989	88336657	30
31	60694088	67786629	76782641	88562776	29
32	60799965	67919089	76952050	88790069	28
33	60906210	68052733	77124223	89018543	27
34	61012855	68185585	77296165	89248201	26
35	61119861	68319630	77468882	89479054	25
36	61227251	68454208	77642381	89711108	24
37	61335023	68589313	77816665	89944373	23
38	61443286	68724977	77991740	90178856	22
39	61551739	68861175	78167612	90414568	21
40	61660676	68997920	78344287	90651519	20
41	61770003	69135315	78521769	90889717	19
42	61879735	69273018	78700066	91129181	18
43	61989843	69411469	78879183	91369917	17
44	62100357	69450434	79059138	91611941	16
45	62211270	69689963	79239905	91855265	15
46	62322584	69830059	79421520	92099899	14
47	62434302	69970726	79603976	92345849	13
48	62546427	70111967	79787381	92593126	12
49	62658961	70253786	79971439	92841739	11
50	62771928	70396188	80156456	93091699	10
51	62885284	70539174	80342336	93342963	9
52	62999069	70682751	80529087	93595620	8
53	63113271	70826919	80716713	93849647	7
54	63227885	70971684	80905219	94105066	6
55	63342920	71117047	81094612	94361964	5
56	63458382	71262014	81264899	94620181	4
57	63574270	71409586	81476087	94879901	3
58	63690599	71556760	81668183	95141050	2
59	63807349	71704564	81861195	95403639	1
60	63924545	71852975	82055127	95667689	0
	9	8	7	6	

The minutes of deg. of the Quadrant for the Secants of the cõplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	84	85	86	
0	95667699	114737188	143355898	60
1	95933224	115119970	143954694	59
2	96200199	115505200	144558602	58
3	96468699	115893242	145167595	57
4	96738699	116283797	145781740	56
5	97010253	116676991	146401101	55
6	97283299	117072851	147025745	54
7	97557932	117471403	147655740	53
8	97834097	117872815	148291269	52
9	98111843	118276840	148932308	51
10	98391211	118683794	149578791	50
11	98672171	119093414	150230942	49
12	98954738	119506013	150888966	48
13	99238930	119921395	151552678	47
14	99524766	120339695	152222283	46
15	99812290	120760985	152897946	45
16	100101406	121185232	153579494	44
17	100392329	121612482	154267179	43
18	100684851	122042752	154961155	42
19	100979193	122476076	155661396	41
20	101275259	122912485	156368008	40
21	101572962	123352094	157081063	39
22	101872522	123794796	157800548	38
23	102173854	124240792	158526854	37
24	102476971	124689886	159259771	36
25	102781890	125142353	159999560	35
26	103088639	125598007	160746221	34
27	103397200	126057149	161499824	33
28	103707656	126519656	162260744	32
29	104019959	126985568	163028671	31
30	104334254	127454936	163804188	30
	5	4	3	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for Secants of the arches of the ſame Quadrant.

	84	85	86	
30	104334254	127454936	163804188	30
31	104650345	127927785	104580930	29
32	104968474	128404152	165377258	28
33	105288542	128884073	166175007	27
34	105610566	129367704	166980877	26
35	105934564	129854921	167794436	25
36	106260557	130345812	168615879	24
37	106588558	130840395	169445565	23
38	106918589	131338917	171283495	22
39	107250680	131841076	171129720	21
40	107584955	132347264	171984331	20
41	107921201	132857174	172847612	19
42	108259554	133371390	173719600	18
43	108600151	133889000	174600528	17
44	108942779	134411212	175490331	16
45	109287702	134937371	176389247	15
46	109634817	135467649	177197417	14
47	109984143	136002135	178215120	13
48	110335695	136540855	179142431	12
49	110689503	137083887	180079354	11
50	111045597	137631223	181016251	10
51	111403988	138183016	181983038	9
52	111764699	138739177	182949802	8
53	112127750	139299830	183926988	7
54	12492167	139865022	184915309	6
55	112861097	140435034	185913898	5
56	113231216	141009514	186922883	4
57	113604036	141588980	187943832	3
58	113979204	142172985	188975484	2
59	114356941	142761997	190018442	1
60	114737188	43355898	191073159	0
	5	4	3	

The minutes of deg. of the Quadrant for Secants of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

	87	88	89	
0	191073159	286537048	572899698	60
1	192139667	288943948	582696234	59
2	193218144	291391704	592749072	58
3	194308793	293881153	603239919	57
4	195411923	296413687	613907444	56
5	196527529	298990299	625070305	55
6	197656082	301612007	636642580	54
7	198797665	304280287	648655621	53
8	199952408	306996123	661136359	52
9	201120639	309760733	674092521	51
10	202302811	312575792	687573461	50
11	203498943	315442491	701612741	49
12	204709326	318362249	716226489	48
13	205934200	321336674	731457951	47
14	207731596	324367065	747258168	46
15	208428431	327455509	763965262	45
16	209698119	330603045	781327254	44
17	210983811	333811800	799496739	43
18	212284911	337083530	818534878	42
19	213602721	340419952	838493969	41
20	214936837	343823703	859455551	40
21	216287619	347295086	881488374	39
22	217655550	350838099	904688629	38
23	219040992	354454051	929138899	37
24	220443931	358145279	954946691	36
25	221865201	361914168	982231437	35
26	223305005	365762313	1011112129	34
27	224763453	369695332	141756449	33
28	226241278	373713015	1074309940	32
29	227738558	377818475	1108967170	31
30	229255885	382015594	1145920768	30
	2	1	0	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

The degrees of the Quadrant for the Secants

of the arches of the ſame Quadrant.

The minutes of the degrees of the Quadrant for the Secants of the arches of the ſame Quadrant.

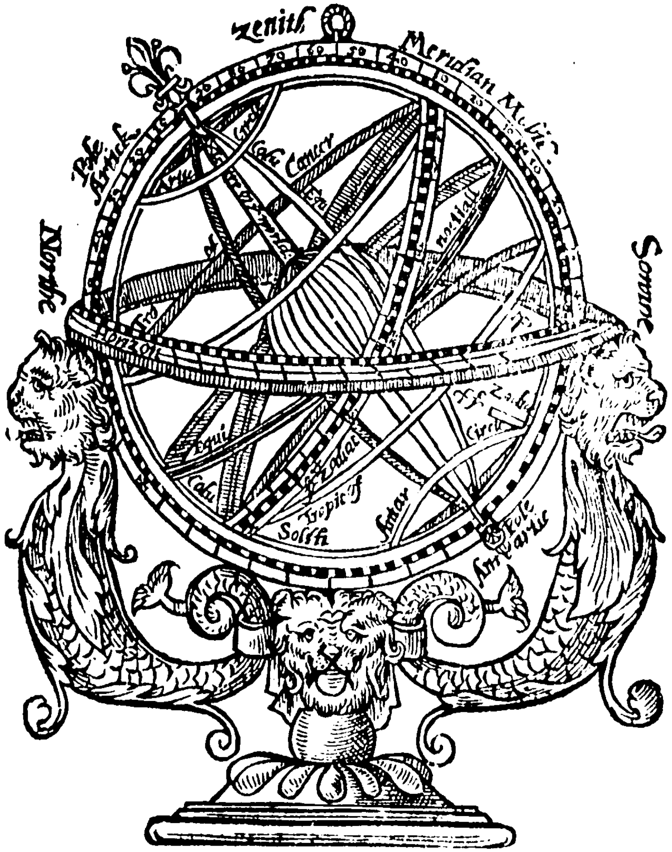
	87	88	89	
30	229255885	382015594	1145920768	30
31	230793400	386307709	1185438054	29
32	232351018	390695734	1227777192	28
33	233931561	395185630	1273252703	27
34	235532822	399780916	1322222495	26
35	237156211	404482275	1375110522	25
36	238802172	409296566	1432397932	24
37	240471230	414226675	1494678912	23
38	242163682	419278406	1562622042	22
39	243880138	424457607	1637033229	21
40	245621193	429757156	1918882212	20
41	247386980	435196961	1809348043	19
42	249178956	440774630	1909068150	18
43	250996850	446498005	2022214532	17
44	252841385	452371994	2148642981	16
45	254713463	458402671	2291835669	15
46	256613211	464596485	2455554190	14
47	258541665	470959629	2644450861	13
48	260499426	477499828	2864894681	12
49	262487060	484224119	3125282743	11
50	264505158	491139838	3437842546	10
51	266554448	498256113	3819709423	9
52	268635944	505583624	4297193526	8
53	270750304	513128995	4911255640	7
54	272898206	520902752	5729642566	6
55	275080457	528915798	6875687278	5
56	277297885	537178989	8594018365	4
57	279551349	545704599	11458691197	3
58	281841763	554505291	17188806508	2
59	284170013	563594031	34376072269	1
60	286537048	572899698	INFINITA	0
	2	1	0	

The minutes of deg. of the Quadrant for the Secants of the cōplements of the arches of the ſame Quadrant.

of the complements of the arches of the ſame Quadrant.

A PLAINE TREATISE
OF THE FIRST PRINCIPLES
of Coſmographie, and ſpecially of the Spheare, repreſenting the ſhape of the whole World.

TOGETHER WITH ALL THE CHIEfeſt and moſt neceſſary vſes thereof, written by M.
BLVNDEVILE, of *Newton Flotman*,
Anno Dom. 1594.



The Heauens declare the glory of God, and the Firmament ſheweth his handy worke, *Pſal.19.*

THE ORDER AND CONTENTS OF THIS TREATISE, TOVCHING THE firſt Principles of Coſmographie, and ſpecially of the Spheare.

Hauing ſet downe the expoſition of certaine termes of Geometry, for the better vnderſtanding of this Treatiſe, I doe firſt define what Coſmography is, and therewith doe briefly ſhew what Sciences it comprehendeth, and who were firſt Inuenters thereof: That done, becauſe the Spheare doth repreſent the ſhape of the whole World, I do define what a Spheare is, and then I do diuide the World into two eſſentiall parts, that is, the Celeſtiall and Elementall part, according to which two parts, I doe diuide this Treatiſe into two Bookes, the firſt whereof treateth of the Celeſtiall part, and the ſecond of the Elementall part of the World, with what order the Chapters of each Booke hereafter following doe plainly ſhew.

The Chapters and Contents of the firſt Booke.

Heere endeth the Contents of the firſt Booke.

The Chapters and Contents of the ſecond Booke, contayning the Elementall part of the World.

A

THE EXPOSITION OF CERTAINE Termes or Principles of Geometrie.

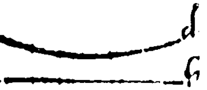
Minding to treat of the Principles of Coſmographie and eſpecially of the Spheare, I thinke it good firſt to expound vnto you certaine Termes of Geometry, without the which the vnlearned ſhall hardly vnderſtand the Contents of this Treatiſe, which Termes are certaine Principles of Geometry, called Definitions. For there are but thrée kindes of Principles, whereon the Demonſtration of all Geometrical concluſions dependeth: that is, Definitions, Petitions, and Maximes; but I minde heere to deale onely with certaine Definitions. Whereof I will ſet downe as many as I thinke néedfull for this purpoſe in ſuch order as followeth.

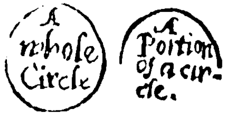
1 A point called in Latine punctus, is a thing ſuppoſed to be indiuiſible, hauing neither length, breadth, nor depth, as the point or pricke a.

2 A line called in Latine linea, is a ſuppoſed length, hauing neither breadth nor thickneſſe, as the line a.b.

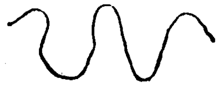
3 The ends or bounds of a line, are two points, and of lines ſome be right, and ſome be crooked.

4 A right line is that which goeth right from one point to another, and not bowingly as doth the line c. d. but ſo ſtraight as is poſſible, as the line a.b. Againe, the crooked line is eyther a whole Circle, or portion of a Circle, or elſe goeth winding in and out, as a Serpent called in Latine Linea tortuoſa, or elſe winding about like the ſhell of a Snaile, called of the Latines Linea ſpiralis, as theſe figures héere doe ſhew.

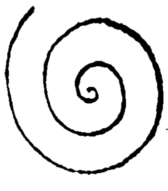




Linea tortuoſa.



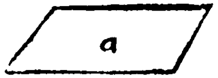
Linea ſpiralis.



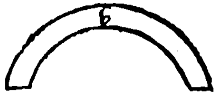
5 Superficies or vpperface is that which onely hath length and breadth, without depth which is two fold, that is to ſay, plaine and crooked.

6 The boundes of Superficies are Lines.

7 A plaine Superficies is that which lyeth ſtraight betwixt his lines, as the figure a. & a crooked Superficies is that which goeth bowing and lyeth not ſtraight betwixt his lines as the figure b. Againe Superficies being conſidered in an hollow bodie, as a barrell Tun or Vault, may be diuided into two other kinds, that is Conuexe, and Concaue, for the vpper part of ſuch a Vault is ſayd to be Conuexe, and the inward part Concaue, as the figure b. ſheweth.

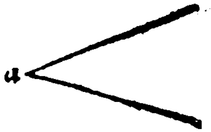


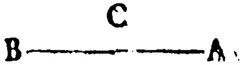
Conuex.



Concaue.

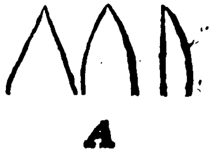
8 A plaine Angle is when two lines being drawne vpon a plaine Superficies, not directly one againſt another, but ſo as by méeting or touching one another in one ſelfe point, they may make a plaine Angle as the Angle, a. For if two lines be drawne directly one againſt another, though they méete in one point, yet they make no Angle, but rather one ſelfe line as the two lines a.b. méeting in the point c.



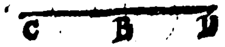


9 Of

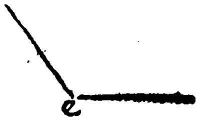
Right crooked mixe.



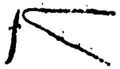
9 Of plaine Angles, ſome are called right line angles, becauſe that both the lines whereof it conſiſteth are right, and ſome are called crooked line Angles, becauſe that both lines are crooked, and ſome are ſayd to be mixt, becauſe the one line is crooked and the other right, as you may perceiue by the three ſundrie ſhapes thereof made in the Margent.



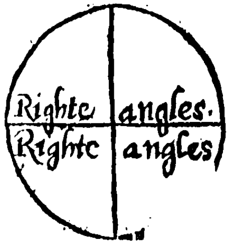
10 If one right line ſtanding vpon another right line, doe make two equall Angles, that is to ſay, of each ſide one, then eyther of thoſe Angles are called right Angles, and the line ſo ſtanding vpon his fellow, is called the perpendicular or plumbe line, as the line a.b. ſtanding vpon the line c.d.

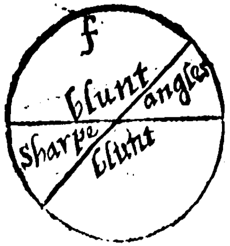


11 A blunt Angle, is that which is greater then a right Angle, as the Angle e.

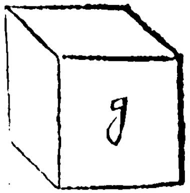


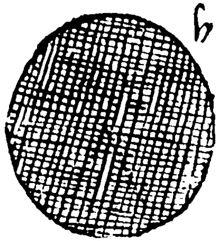
12 A ſharpe Angle, is that which is leſſer then a right Angle, as f. ſo as there bee in all three Angles; that is right, blunt, and ſharpe, in Latine rectus, obtutus, & acutus. And beſides theſe Angles, there be alſo certaine Sphericall, that is to ſay, round Angles, which conſiſt of two circular lines drawne vpon a Sphericall ſuperficies, which doe croſſe one another in ſom point, either rightly or obliquely: if rightly, then they make right Angles, on each ſide of the point where they croſſe, as the figure E. ſheweth, if obliquely, then they make ſharpe Angles, on the inſide, and blunt Angles on the out ſide of the point, where they croſſe, as the figure F. doth partly ſhew, for ſuch Angles cannot bee ſo wel deſcribed in Plano, as vpon the ſuperficies of ſome Sphericall bodie.



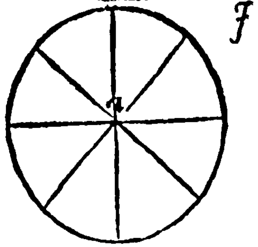


13 A terme called in Latine terminus, is the bound or limit of any thing, as points are the bounds of lines, and lines the bounds of ſuperficies, and ſuperficies the boũds of a body, which is that which hath imaginatiuely, but not materially, both length, bredth and depth, and if ſuch body haue many faces or ſides, then it is bounded with many ſuperficieſſes, as the figure G. made like a ſix-quare Die. But if ſuch bodie bee round as a Bowle, Spheare or Globe, then it is bounded or couered with one ſuperficies only, as the figure H. doth ſhew.





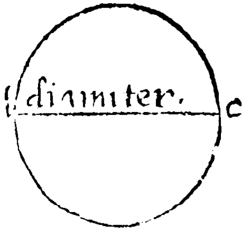
14 A figure is that which is comprehended within one bound, or many bounds.



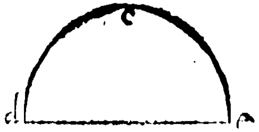
15 A circle is a plaine figure bounded with one circular Line, which is called the circumference, vnto the which as many right Lines as are drawne from the point ſtanding in the middeſt, are all equall one to the other, that is to ſay, one is as long as another, as the figure I. here doth ſhew.

16 And the middle point of a circle is called the Center, as the point A. in the figure I.

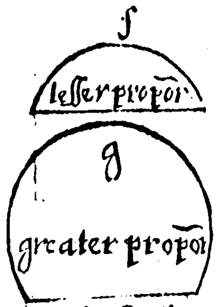
Circumference.



17 The Diameter of the Circle, is a right Line paſſing thorow the Center, from one ſide of the circumference to the other, which diuideth the Circle into two equall parts; as the line B. C.



18 A Semicircle is a figure, contayned within the Diameter, and halfe the circumference of a Circle, as the figure C.D.E.

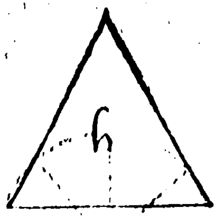


The Cord.

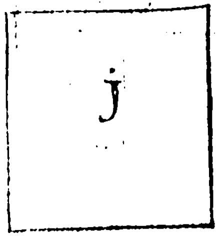
19 The portion of a Circle is a part of a Circle, greater or leſſer then the Semicircle, as the figures F. and G. do ſhew the right line in either of which figures is called in Latin chorda, in Engliſh the ſtring, and the Circular line in Latine is called arcus, in Engliſh the bow, but the Diameter is alwayes the greateſt chord in a circle.

20 Right-lined Figures, are thoſe which are bounded with right lines.

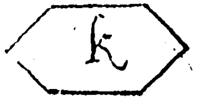
21 Triangles or three chorded figures are thoſe which are bounded with three right lines, as the figure H.



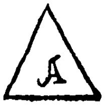
22 Foure Square figures, are thoſe which are bounded with foure right lines, as the figure I.



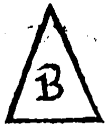
23 Many ſquare figures, are thoſe which are bounded with more right lines then foure, as K.



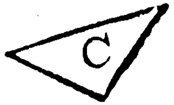
24 Of Triangles or three-cornerd figures, there be ſix kinds, whereof the firſt is called equilater, hauing three equall ſides and three equall Angles, as A.



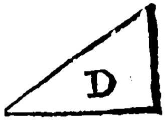
25 The ſecond is called, Iſoſceles, hauing but two equall ſides and Angles, as B.



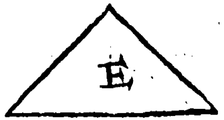
26 The third is called ſcalenos, hauing no ſide equall one with the other, but one ſhorter or longer then another, as C.



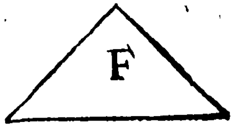
27 The fourth is called Orthogonius hauing one right Angle, as D.



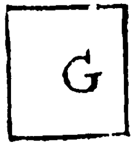
28 The fifth Angle is called Ambligonium, becauſe it hath one blunt Angle, as E.



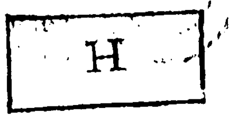
29 The ſixth is called Oxigonius becauſe it hath three ſharpe Angles, but not equall ſides, as F.



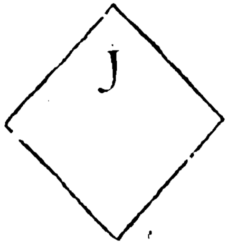
30 Of foure ſquare figures there is one iuſt foure ſquare, hauing foure equal ſides, and is right angled, as G.



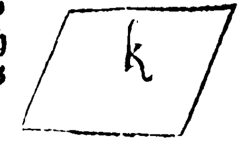
31 Another is called a long Square which is right angled, but not hauing foure equall ſides, as H.

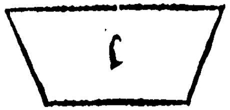


32 There is another called Rombus, that is to ſay, a Turbut in ſhape like to a Diamant which hath foure equal ſides, but is not right angled, as I.



33 There is another called Romboides, which though it hath ſides and Angles one right againſt another, yet hath it neither foure equall ſides, nor yet is right angled, as K.

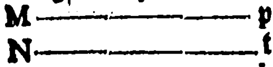




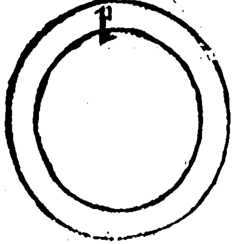
34 All other kindes of foure ſquares are called trapezia, and L. and ſuch like.

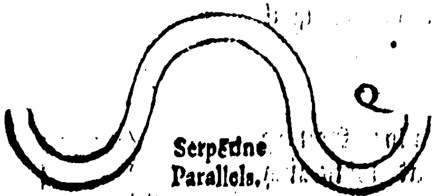
35 Parallels are two right Lines equally diſtant one from another, which being drawne forth infinitely, would neuer touch or méete one another in any part, as the two lines M.N. And though the lines be circular, yet if they be equally diſtant in all places one from another, they are alſo called parallels, as the figure P. ſheweth, yea though the lines be winding in and out as Serpents, if they be equally diſtant in all places one from another, they are parallels as well as if they were right lines, as the figure Q. ſheweth.

Right Line parallels.



Circular parallels.





Serpẽtine Parallels.

THE FIRST PART OF THE SPHEARE.

CHAP. I.

Of Coſmographie, what it is, and what kinds of Sciences it comprehendeth, and who were firſt Inuenters thereof.

WHat is Coſmographie?

Coſmographie is the deſcription of the whole World, that is to ſay, of Heauen and Earth, and all that is contayned therein.

What ſpeciall kinds of knowledge are comprehended vnder this Science.

Theſe foure Aſtronomy, Aſtrology, Geography and Chorography.

What is Aſtronomie?

Aſtronomy is a Science, which conſidereth & deſcribeth the magnitudes and motions of the celeſtiall or ſuperiour bodies.

Which call you ſuperiour bodies?

The Spheares or Heauens, and the ſtars as well fixed as mouable, which we ſhal define hereafter in their proper places.

What is Aſtrologie?

It is a Science, which by conſidering the Motions, Aſpects, and influences of the ſtarres, doth forſée and prognoſticate things to come.

What is Geographie?

It is a knowledge teaching to deſcribe the whole earth, and all the places contayned therein, whereby vniuerſall Maps and Cards of the Earth and Sea are made.

What is Chorographie?

It is the deſcription of ſome particular place, as Region, Ile City, or ſuch like portion of the Earth ſeuered by it ſelfe from the reſt.

Who are the firſt Inuenters of theſe Sciences?

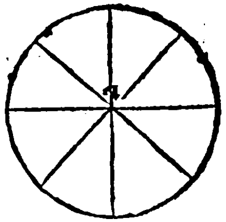
Some ſay that Atlas was the firſt inuenter, whom the Poets faine to beare vp the Heauens with his ſhoulders, hauing his head placed in the North-pole, and his feet in the South-pole, and his right hand bearing the Eaſt part, and his left hand the Weſt part of the World. Albeit that ſome apply this fiction of the Poets to an high Mountaine in Africa called Atlas, which for his great height ſurmounting the clouds, is ſaid to beare vp the Skies. But ſome ſay that Adam our firſt Parent, was the firſt inuenter thereof: and ſome others affirme that Abraham was the firſt inuenter thereof. But whoſoeuer was the firſt inuenter, it well appeareth by Ptolomey his Book, called Almageſti, that he hath beene no ſmall furtherer thereof, and ſince his time in theſe latter daies Georgius Purbacchius, Ioannes de Monte Regio, Copernicus, and diuers others haue learnedly treated thereof. But leauing to ſpeake of the firſt inuenters, or of the furtherers of theſe Sciences, I will ſpeake of the ſhape, capacitie, and vnitie of the World. And becauſe the ſhape thereof is likened to a round bodie called a Spheare, I will firſt define what a Spheare is.

CHAP. II.

The definition of a Spheare, and of the vnitie, roundneſſe, and capacitie of the World: alſo of the Poles and Axle-tree thereof.

WHat is a Spheare?

A Spheare is a round bodie, contayned or couered with one only ſuperficies or vpper-face, in the midſt of which bodie is a point or pricke, called the Center, from which all right lines being drawne to any part of the ſuperficies or vpper part thereof, are of equall length, as you may perceiue by this figure heere following, the Center whereof is marked with the letter A.



And this Spheare before defined repreſenteth the frame of the whole World, contayning all things, and is contayned of none.

How prooue you that there is but one World?

By the authority of Ariſtotle, who ſaith, that if there were any other World out of this, then the Earth of that World would mooue towards the Center of this world, which cannot be, vnleſſe it ſhould firſt aſcend from his owne Center to the ſuperficies or vpper-face of the ſame, which is againſt nature, for euery heauy thing naturally tendeth downeward, and euery light thing vpward, which common experience ſheweth: for a ſtone being caſt vpwards, will fall downeward, and the flame of a Candle being turned downeward, will flye vpward.

How proue you the frame of the World to be round?

By three reaſons, Firſt, by compariſon, for the likenes, which it hath with the chiefe Idea or ſhape of Gods mind, which hath neither beginning nor ending, and therefore is compared to a Circle. Secondly, by aptnes as well of moouing as of contayning, for if it were not round of ſhape, it ſhould not be ſo apt to turne about, as it continually doth, nor to contayne ſo much as it doth, for the round figure is of greateſt capacitie and contayneth moſt. Thirdly, neceſſity prooueth it to be round, for if it were with Angles or Corners, it ſhould not be ſo apt to turne about, and in turning about, it ſhould leaue void and emptie places, which nature abhorreth, for no place by nature can bee without a bodie, nor a bodie without a place.

Whereupon is this Spheare or great round frame turned?

Vpon two moſt firme and immoueable hookes, called in Latine, Cardines mundi, and in Greeke Poli, deriued of the Verbe Bolo, which is as much to ſay, as to turne. For as a doore turneth vpon his hookes, ſo the world turneth vpon his two poles, whereof the one is fixed in the North, and the other in the South, and the North pole is called in Latine Polus arcticus, and the South pole is called Antarcticus, through which poles from the one to the other paſſeth a right imaginatiue line, called of the Aſtronomers the Axle-tree of the World, about the which the World continually turneth like a Cart-wheele, which you may ſee liuely expreſſed in a materiall ſpheare made for the purpoſe, for in Plano it cannot be ſo well deſcribed.

CHAP. III.

Of the diuiſion of the World, and of the two eſſentiall parts thereof, and what things each part contayneth.

HOw is the World diuided?

Moſt Writers doe make a two-fold diuiſion thereof, that is, according to ſubſtance, and according to accidents, which accidents, becauſe they are none other thing, but points, lines, and circles, and ſo incident and neceſſarily belonging (by poſition though not by nature) to the ſubſtantiall parts, as the one cannot be deſcribed without the other, neither the ſubiect without the accidents, nor the accidents without their ſubiects, I will therefore make but one diuiſion of the World, diuiding the ſame into two eſſentiall parts, that is, the celeſtiall part, and the elementall part, in the deſcription of which parts, it ſhall alſo plainly appeare what thoſe lines and circles bee, and to what end they ſerue.

What doth the celeſtiall part contayne?

The eleuen Heauens and Spheares.

Make you no difference betwixt theſe Spheares, and the great Spheare which you laſt defined to bee couered with one ſuperficies, or vpper-face

Yes verily, for theſe haue two ſuperficies or vpper faces, that is, the Conuexe and Concaue.

Which call you Conuexe? and which Concaue?

The Conuexe is the outermoſt vpper-face of any thing that is round, and therewith hollow, as of an Ouen or Vault, and the Concaue is the innermoſt or hollow ſuperficies of the ſaid Ouen or Vault, or of any ſuch like round bodie hauing concauitie or hollowneſſe.

Which be thoſe eleuen Spheares, or Heauens, whereof you did laſt ſpeake?

In aſcending orderly vpwards from the Elements they bee theſe, The firſt is the Spheare of the Moone, The ſecond the Spheare of Mercurie, The third the Spheare of Venus, The fourth the Spheare of the Sunne, The fifth the Spheare of Mars, The ſixth, the Spheare of Iupiter, The ſeuenth, the Spheare of Saturne, The eighth the Spheare of the fixed ſtars, commonly called the Firmament, The ninth is called the ſecond moueable or Chriſtall Heauen. The tenth is called the firſt moueable, and the eleuenth is called the Imperiall Heauen, where God and his Angels are ſaid to dwell.

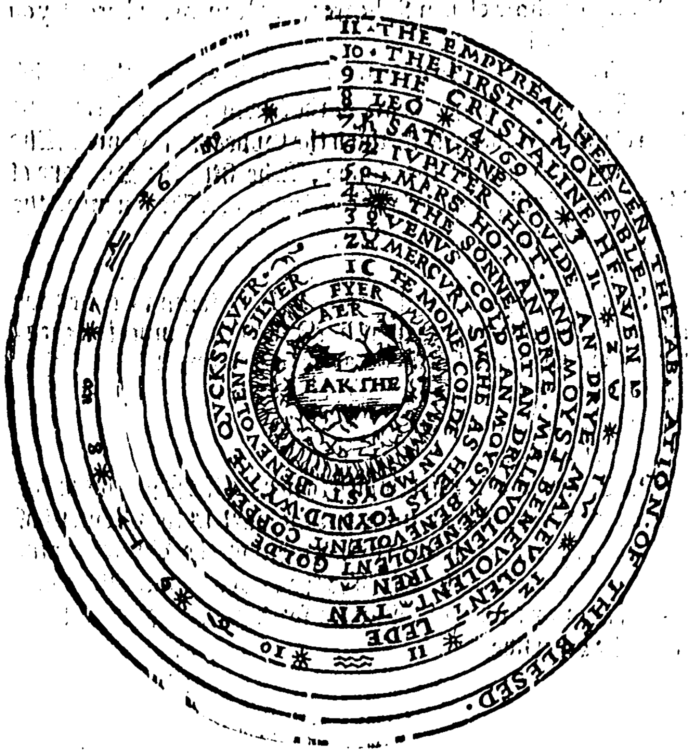
What doth the Elementall part contayne?

It contayneth the foure Elements.

Which be thoſe?

The Element of the fire, which is next to the Spheare of the Moone, and next to that more downeward is the Element of the Ayre, and next to that is the Element of the Water, and next to that is the Earth, which is the loweſt of all. All which things you may ſee heere plainly ſet forth in this figure following on the other ſide.

A figure of the whole World, wherein are ſet forth the two eſſentiall parts before mentioned, that is to ſay, the eleuen Heauens, and the foure Elements.


11 THE EMPYREAL HEAVEN THE ABATION OF THE BLESED
10 THE FIRST MOVEABLE HEAVEN
9 THE CRISTALINE HEAVEN
8 LEO
7 ♄ SATVRNE COVLDE AN DRYE MALEVOLENT LEDE
6 ♃ IVPITER HOT AND MOYST BENEVOLENT TYN
5 ♂ MARS HOT AN DRYE MALEVOLENT IREN
4 THE SONNE HOT AN DRYE BENEVOLENT GOLDE
3 ♀ VENVS COLD AN MOYST BENEVOLENT COPPER
2 ☿ MERCVRI SVCHE AS HE IS TOYNLD WYTH QVCKSYLVER
1 ☾ THE MONE COLDE AN MOYST BENEVOLENT SILVER
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CHAP. IIII.

A demonſtration to proue the plurality of the Heauens.

HOw is it to be proued that there is ſuch multiplicitie of Heauens, ſith to the Eye it ſeemeth one whole bodie?

If there were not diuers heauens and diuers motions, there ſhould neither bee generation nor corruption of any thing; for all things then ſhould bée as one, and euer in one eſtate. But beſides that reaſon men haue found out by experience in obſeruing the diuers riſing and ſetting of diuers ſtarres called the Planets, that euery ſuch Planet hath a ſeueral Spheare or Heauen by it ſelfe, for otherwiſe they ſhould continually kéepe the places as the fixed ſtars doe, which doe mooue altogether according to the moouing of the eighth Heauen wherein they are placed.

I grant that there may bee diuers Heauens or Spheares. But how proue you that there bee ten moueable Heauens, beſides the Imperiall Heauen before mentioned, and ſpecially ſith of the old Writers, ſome affirme, that there be but nine, and ſome haue ſaid that there be no more then eight?

The later Writers haue found by good obſeruation (as they ſay) that the Firmament or eighth Heauen hath thrée ſeuerall motions wherewith it is moued and turned about, which could not be, vnleſſe there were two moueable heauens higher then that, as ſhall be declared when we come to ſhew the thrée-fold motion of the ſaid eighth Heauen. For here I mind briefly to deſcribe vnto you all the Heauens, beginning at the higheſt, and ſo procéed to the loweſt.

CHAP. V.

Of the higheſt Spheare or Heauen, called the imperiall Heauen.

THe imperiall Heauen (as our ancient Diuines affirme) is immoueable, and being created by God the firſt day that he began the firſt Creation of the World, was by him immediately repleniſhed with his Miniſters the holy Angels, and this Heauen being the foundation of the World, is moſt fine and pure in ſubſtance, moſt round of ſhape, moſt great in quantitie, moſt cleare in qualitie, and moſt high in place, where God and his Angels are ſaid to dwell.

CHAP.

CHAP. VI.

Of the tenth Spheare or Heauen, called in Latine, Primum mobile, *that is the firſt moueable, and what motion it hath.*

This heauen is alſo of a moſt pure and cleere ſubſtance, and without ſtarres, and it continually moueth with an equall gate from Eaſt to Weſt, making his reuolution in 24. houres, which kind of mouing is otherwiſe called the diurnall or daily mouing, and by reaſon of the ſwiftneſſe thereof, it violently carryeth and turneth about all the other heauens that are beneath it from Eaſt to Weſt, in the ſelfe ſame ſpace of 24 houres, whether they will or not, ſo as they are forced to make their owne proper reuolutions, which is contrarie from Weſt to Eaſt euery one in longer or ſhorter time, according as they be farre or neere placed to the ſame: yet ſome Writers doe not admit any violence in the heauens, but that euery heauen hath his proper and naturall mouing without any violence.

I doe not well vnderſtand by what reaſon the firſt moueable ſhould haue ſuch force ouer the reſt.

For your better vnderſtanding how this may bee, ſuppoſe that you turne with your hand from Eaſt to Weſt a Grindſtone, or ſome other turning wheele, whereon is placed a Flye or ſome other creeping Worme, which commeth towards you from Weſt to Eaſt, and you ſhall eaſily conceiue that by your ſwift turning of the wheele, you ſhal turne about the ſaid Flye or Worme, many times contrary to her owne courſe, whether ſhe will or not, before ſhe can get about the ſaid ſtone or wheele.

That is true, proceed therefore to the reſt, and tell the nature and mouing of the ninth Heauen.

CHAP.

CHAP. VII.

Of the ninth Heauen, what motions and names it hath, and whether there be any waters aboue the Firmament or not.

The ninth Heauen is alſo cleere of ſubſtance, and without ſtarres, hauing two mouings, the one from Eaſt to Weſt vpon the poles of the world, according to the daily mouing of the firſt moueable, and the other from Weſt to Eaſt vpon his owne poles, according to the ſucceſſion of the ſignes of the Zodiaque, which is in the firſt moueable, turning ſo ſlowly about as it maketh but one degree in 100. yeares, and accompliſheth his full reuolution in 36000. yeares, or as Alphonſus ſaith in 49000. yeares.

Is there then in the firſt moueable any Zodiaque, that is to ſay, a broad Circle carrying the twelue ſignes and yet no ſtars?

Yea: though there be no ſtars, yet many ſuperſtitious fooles doe imagine that there be diuers Characters, and lineaments not to be ſeene, but with a moſt ſharpe and ſubtill ſight; by vertue of which Characters and fayned Conſtellations, they imagine that they can worke wonders and ſtrange effects, enough to deceiue themſelues and others too.

What is the cauſe that the ninth Heauen is ſo long in making his proper reuolution?

Becauſe, as I ſaid euen now, this Heauen is placed next to the firſt moueable, which carryeth him about contrarie to his owne courſe, with ſuch violence as hee cannot make his owne proper reuolution ſo ſoone as the other Heauens, which are placed further off.

If the ninth Heauen be ſo long in making his courſe, it will neuer bee compleate whileſt the World laſteth, for the whole Age of the World according to ſome, is but 6000. yeares.

Yet Plato was of another opinion, and therefore this reuolution was called magnus annus Platonis, that is to ſay, the

great

great yeare of Plato, becauſe he affirmed that when this reuolution was once complete; all things ſhould bee in the ſame eſtate wherein they were at the firſt, and that hee ſhould then ſtand reading to his ſchollers in the ſelfe-ſame chaire wherein he ſtood at that preſent: which fond opinion S. Auguſtine confuteth in his twelfth Booke de Ciuitate Dei, ſpeaking in this maner, God forbid (ſaith he) that we ſhould credit theſe things, for Chriſt dyed once for our ſinnes, and being riſen againe from the dead, he is no more to die, neither can death haue any more power ouer him, by vertue of whoſe reſurrection, we alſo that beleeue ſhall riſe againe, and dwell with God for euer.

By what name is this ninth Heauen called?

Some doe call it the Chriſtalline Heauen, becauſe of the cleereneſſe thereof, and ſome the watrie Heauen, becauſe the Scripture affirmeth that there bee waters aboue the Firmament, as we reade in Gen. cha. 1. Let the Firmament be made, and diuide the waters from waters. Againe wee reade in the Pſalmes, All ye waters that be aboue the Firmament, bleſſe ye the Lord.

The naturall Philoſophers allow no waters to dwell aboue the Firmament.

That is true, yet notwithſtanding if the holy Scriptures do manifeſtly affirme, that there be waters aboue the Firmament, it behooueth a Chriſtian to beleeue it: but queſtion perhaps may be moued, what manner of waters they are that are aboue the firmament, whether ſuch as breed raine, or whether they are only to be referred to the Chriſtalline heauen, becauſe it is of a watry ſubſtance, and therefore of ſome is called the watrie Heauen, affirming it to bee placed next to the primum mobile, or firſt moueable, to the intent that with the coldneſſe thereof it might aſſwage and repreſſe the extreame heate of the ſame primum mobile, which otherwiſe (as ſome affirme) with his ſwift & violent mouing, would ſet all the Heauens on fire, and yet no raine is bred therein, for the great raine that drowned the World in Noahs time, did not fall from aboue the Firmament, but from the Ayre, which in the holy Scriptures is many times ſignified by this Latine word Cœlum, that is to ſay, Heauen, as when the Scripture ſaith, the floud-gates of Heauen were opened, in as much to ſay as the floud gates of the Ayre were opened, &c. But leauing this queſtion, let vs proceed to the eight Heauen.

CHAP. VIII.

Of the eighth Heauen: what motions it hath, and what circles are imagined by the Aſtronomers to bee in that Heauen, and to what vſe and purpoſe they ſerue: Alſo in what time euery one of the ſeuen Planets maketh his reuolution, And of what thickneſſe their Spheares be.

The eighth Heauen otherwiſe called the Firmament is a moſt glorious Heauen, adorned with all the fixed ſtarres.

Why are they called fixed?

Becauſe they are faſtned in this Heauen, like knots in a knottie board, hauing no moouing of themſelues, but are mooued according to the moouing of this eight Spheare, or Heauen, wherein they are fixed.

How manifold is the mouing of this Heauen?

The mouing of this Heauen (as hath bin ſaid before) is threefold. For firſt it turneth about euery day from Eaſt to Weſt in 24. houres, according to the mouing of the firſt moueable, otherwiſe called the diurnall mouing. Secondly, it moueth from Weſt to Eaſt, according to the moouing of the ninth Heauen, which maketh but one degree in an hundred yeares, and this mouing is called motus augium Stellarum fixarum.

What are Auges?

They be certaine imagined points in the heauen, notifying the furtheſt diſtance of any Orbe or Spheare from the Center of the world: Thirdly, it moueth ſometime towards the South, and ſometime towards the North, by vertue of his owne proper moouing, called in Latine motus trepidationis, that is to ſay, the trembling, mouing, whereby it is mooued vpon two little Circles; the Poles whereof are in the beginning of that Aries and that Libra, which are imagined to bee in the ninth

Heauen,

Heauen the Semidiameter of which little Circle is foure degrées, 1′8. and 4″3. and maketh his whole reuolution in 7000 yeares, and this mouing is otherwiſe called motus acceſſus & receſſus, that is to ſay, the mouing of approching and retyring, and is only proper to the eight Spheare: for euery naturall bodie by order of nature, can haue but one proper mouing, and by reaſon of this mouing, the fixed ſtarres bée not alwaies equally diſtant from the immoueable poles of the tenth Spheare, nor alwaies vnder the Ecliptique of the ſaid tenth Spheare, but oftentimes cleane without it. Nor the fixed ſtars are in equall times equally diſtant from the beginning of that Aries and Libra, which are imagined to be in the tenth heauen, but they ſéeme to moue ſometime towards the Eaſt, and ſometimes towards the Weſt, now more ſwiftly, and now more ſlowly. For Ptolomy in his time found them to be mooued in 100. yeares one degrée. And the later Obſeruers haue found them when they bée in their ſwift motion to bée moued one degrée in 36. yeares, all which thrée mouings are eaſie (as ſome affirme) to bée demonſtrated by one inſtrument made of purpoſe, ſhewing euery ſeuerall mouing of this heauen by it ſelfe, but ſuch demonſtrations, as ſome others thinke be not altogether neceſſarie concluſions: for it may bee that the daily mouing is common to the whole frame, and that the mouing of the Auges of the fixed ſtarres, is proper to the eighth Spheare, hauing ſome other mouer, and the like obiection may be made touching the trembling mouing, called motus trepidationis. But now you haue to vnderſtand that for the better deſcribing, diuiding, and meaſuring of this Heauen, and all the apparences thereof, the Aſtronomers with the penſill of imagination, or rather of moſt neceſſary inuention, doe (as it were) trace the ſame with certaine Circles both greater and leſſer, whereof wee ſhall ſpeake as ſoone as wee haue briefly ſhewed the mouing of the reſt of the Heauens, contayned in the celeſtiall part of the World, in ſuch order as they follow one another. For next to the Firmament is the Heauen of Saturne, which maketh his reuolution from Weſt to Eaſt in thirtie yeares, next to him is the Heauen of Iupiter, who maketh his

reuolution from Weſt to Eaſt in twelue yéeres, next to him is the Heauen of Mars, which maketh his reuolution alſo from Weſt to Eaſt in two yeares, next to him is the Heauen of the Sun which maketh his reuolution from Weſt to Eaſt in 365. dayes, and ſix houres lacking certaine minutes, next to him is the heauen of Venus, which maketh his reuolution from Weſt to Eaſt in like time as doth the Sunne, next to Venus is the heauen of Mercurie, which maketh her reuolution from Weſt to Eaſt in the like ſpace that Venus doth: And next to Mercury is the heauen of the Moon, which maketh her reuolution from Weſt to Eaſt in 28. dayes and certaine minutes. Thus hauing briefly deſcribed the eleuen Heauens, I will now treate of the circles that are imagined (as I ſaid before) by the Aſtronomers to be in the eight heauen or firmament, to the intent that the meaſures and diſtances of the ſtarres, images, ſignes, and other apparances therein contayned, might bee the better demonſtrated.

Before you deale with theſe Circles, I would gladly vnderſtand ſome reaſon why all theſe ſeuerall heauens ſeeme to the eye, but as one entyre bodie.

That is, becauſe they are all cléere and tranſparent like fine Birall Glaſſe, or Chriſtall, through the which the ſight doth eaſily pierce, though there were neuer ſo many Coates of ſuch cléere ſubſtance, couering one another like the ſkales of an Onion, for ſo the heauens doe couer and encloſe one another, and euery one is of an excéeding great thickneſſe.

Why, how thicke is euery ſuch Heauen?

The heauen of the Moon contayneth in thickneſſe. —————— 105/222. $\frac{2}{33}$ miles.
The heauen of Mercurie contayneth —————— 253372 $\frac{2}{3}$
The heauen of Venus, —————— 3274494 $\frac{0}{11}$
The heauen of Sol, —————— 343996 $\frac{4}{31}$
The heauen of Mars, —————— 26/208/800
The heauen of Iupiter, —————— 1899654. $\frac{6}{11}$
The heauen of Saturne, —————— 19604454. $\frac{6}{11}$

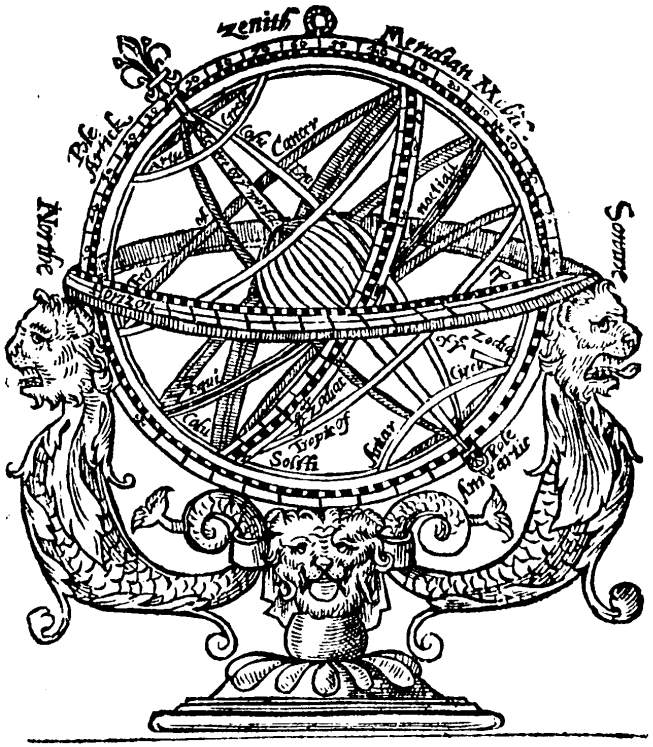
What need haue the heauens to be ſo thicke?

Becauſe otherwiſe they could not contayne each one his ſtar or ſtarres, for there is no fixed ſtarre ſo little, but that it is farre greater in compaſſe then the earth, neither is there any wandring ſtarre, but that it is bigger then the earth, the Moone, Venus and Mercury excepted.

For the Sunne contayneth the earth———— 166. times.
Saturne contayneth it———————— 95. times.
Iupiter contayneth it———————— 91. times.
Mars contayneth it———————— 2. times.
Venus is leſſer then the earth———————— 39. times.
Mercury is leaſt of all, and is contayned of the earth,———————— 3143. times.

You haue well ſatisfied me touching theſe matters, and therefore now proceed with the Circles if you thinke ſo good.

Before that I deſcribe vnto you the Circle whereof a Spheare is made, or declare the vſes thereof: I thinke it not amiſſe heere to ſet downe the ſhape of a Spheare, together with the names of euery Circle written vpon the ſame, to the intent that you may be acquainted with all the parts of a Spheare before you come to vſe the ſame: which ſhape or figure, was firſt drawne by Maſter Blagraue, and is ſet downe in his booke called the Mathematicall Iewell.



Chap. IX.

Of the Circles whereof a materiall Spheare conſiſteth, and of their diuers diuiſions.

Of Circles which are imagined to be in the firmament, and whereof a Spheare repreſenting the ſhape of the World is commonly made, bee in all ten, that is to ſay, the Equinoctiall, the Zodiaque, the two Colures, the Horizon, the Meridian, the two Tropiques, and the two polar circles, of which circles ſome be greater and ſome leſſer.

Which call you greater and which leſſer?

Thoſe are called the greater circles, which paſſing through the Center or midſt of the Firmament, do diuide the whole circuit thereof in two equall parts, and of ſuch Circles there bee ſix, that is to ſay, the Equinoctiall the Zodiaque, the Colure of the Solſtices, the Colure of the Equinoxes, the Horizon, and the Meridian. The leſſer Circles are the foure laſt mentioned, that is, the two Tropiques, and the two polar Circles, which are called leſſer, becauſe they doe not diuide the world into two equall parts, but into vnequall portions.

What other diuiſions doe the Aſtronomers make of the ſaid Circles?

Diuers, for ſome are ſaid to be Parallels, ſome right, ſome oblique, ſome moueable, and ſome immoueable.

Which are ſaid to be Parallels?

The two Polar Circles, and the two Tropiques, and the Equinoctiall which is in euery middeſt of them all.

Which are ſaid to be right, and which oblique?

The right be the two Colures, the right Horiſon, and the Meridian becauſe they cut the Spheare or Globe with right Angles: And the oblique are theſe two, that is, the Zodiaque, and the oblique Horiſon, which are ſaid to be oblique, becauſe they cut the Spheare or Globe with oblique Angles.

Which are ſaid to be moueable, and which immoueable?

The moueable are theſe, the Equinoctiall the Zodiaque, the two Tropiques, and the two polar Circles; which are ſaid to be moueable, becauſe they continually moue with the Firmament, and are like in all places. And theſe alſo hauing reſpect to a materiall Spheare, are ſaid to bee intrinſicall or inward. The immoueable are theſe two, that is, the Horizon, and the Meridian, which are ſaid to be immoueable, becauſe in the turning of the Spheare they remaine vnmoued, for though we change both Meridian and Horizon by going from one habitation to another vpon the Earth, yet euery place hath ſtill his owne Meridian and Horizon, which do remaine immoueable, and theſe two circles hauing reſpect to a material Spheare, are ſaid to be extrinſical or outward, becauſe they do encloſe on the

outſide all the other Circles of a materiall Spheare. Thus hauing ſet downe the diuiſions of the ſaid Circles, I will now deſcribe them all in order, and ſhew to what vſes they ſerue, beginning firſt with the great Circles, and ſo proceed to the leſſer, and firſt I will ſpeake of the Equinoctiall.

CHAP. X.

Of the Equinoctiall Line, why it is ſo called, and of the diuers vſes thereof.

WHat is the Equinoctiall?

The Equinoctiall is a great Circle, which being in euery part equally diſtant from the two Poles of the World, diuideth the Spheare in the very middeſt thereof, into two equall parts, and therefore it is called of ſome, the girdle of the World.

Wherefore is it called by the name of the Equinoctiall?

Becauſe that when the Sunne toucheth this circle, which is twice in the yeere, the day and night is of equal length throughout the World.

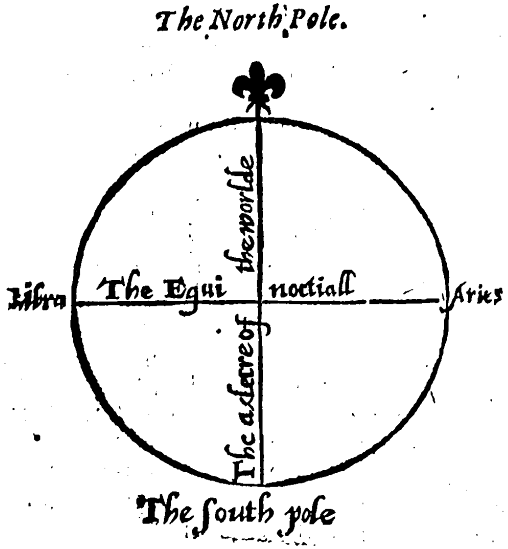
At what time of the yeare is it Equinox?

In the ſpring of the yeare, about the eleuenth day of March, when as the Sunne entereth into the firſt degree of Aries, and againe in Autumne about the thirteenth of September, when as the Sunne entreth into the firſt degree of Libra. And by reaſon that this circle diuideth the world in the very middeſt, thoſe that dwell right vnder it, are ſaid to haue no Latitude either Northward or Southward, to whom the dayes and nights are alwayes equall. But if they dwell any thing diſtant from the Equinoctiall, towards any of the Poles, then they are ſaid to haue Latitude more or leſſe, either Southward or Northward, as ſhall be declared hereafter more at large, when wee come to treat of the Longitude and Latitude of the earth, both which are to be knowne by helpe of the Equinoctiall.

To what other vſes ſerueth this Circle?

This Circle hath many moſt neceſſary vſes, for firſt it ſheweth the daily mouing of the firſt moueable, which maketh his reuolution in 24. houres, which houres are equall, and are to be meaſured by the degrées of the Equinoctiall, by allowing 15. degrées thereof to an houre. And therefore the degrées of the Equinoctiall are commonly called in Latine of the Aſtronomers, *tempora*, of which degrée it contayneth 360. which being diuided by 15. doe make 24. houres, which is a naturall day, contayning both day and night: Moreouer, it ſheweth the declination of the fixed ſtars and their right aſcentions, whereof we ſhall ſpeake when we come to treate of the ſtars; and by his equall motion, all the inequalities of the Zodiaque, and of all the ſignes contayned therein, are meaſured: and to be ſhort, this Circle hath many other good vſes, not to be declared vntill you haue ſome knowledge of the reſt of the other Circles hereafter deſcribed.

A figure ſhewing the Equinoctiall Line, the two Poles, and Axle-tree of the World.



CHAP. XI.

Of the Zodiaque, why it is ſo called, and of the twelue Signes therein contayned: alſo of the Latitude, Longitude, and declination thereof.

WHat is a Zodiaque?

It is a broad, oblique, or ſlope Circle, hauing a circular line in the middeſt thereof, called the Ecliptique line, and diuideth the Spheare into two equall parts, by croſſing the Equinoctiall with oblique Angles in two pointe, that is, in the beginning of Aries, and in the beginning of Libra, ſo as the one halfe of this broad Circle declineth towards the North, and the other halfe towards the South: in which Circle many things are to bee conſidered, firſt the name, then that breadth it hath, and why it hath ſuch breadth, and into what parts it is diuided as well touching the breadth or latitude, as circuit or longitude thereof, alſo into how many parts the firmament is diuided by the ſpaces deſcribed in the Zodiaque, and appointed to the twelue ſignes. Alſo how much it declineth from the Equinoctiall towards the South or North, and vpon what Poles it turneth about, and why the line in the middeſt is called the Ecliptique line, and many other neceſſarie points, which I minde héere briefly to touch.

Why is this Circle named the Zodiaque?

It is named the Zodiaque either of this Gréeke word zoe, which is as much to ſay, as life, becauſe the Sunne being moued vnder this Circle, giueth life vnto the inferiour bodies, or elſe of this Gréeke word Zodion, which is as much to ſay, as a beaſt, becauſe that twelue Images of ſtarres, otherwiſe called the twelue Signes, named by the name of certaine beaſts, are formed in this Circle: and therefore the Latines doe call this Circle Signifer, becauſe it beareth the twelue ſignes.

How are theſe Signes called, and with what Characters are they marked?

Their names and Characters, this Table héere following doth ſhew, and alſo which be oppoſite one to another, as Aries be Libra, Taurus to Scorpio, and ſo forth.

The ſix Northerne Signes.		Th ſix Southerne Signes.	
Aries	♈	Libra	♎
Taurus	♉	Scorpio	♏
Gemini	♊	Sagittarius	♐
Cancer	♋	Capricornus	♑
Leo	♌	Aquarius	♒
Virgo	♍	Piſces.	♓

Of which Signes the firſt ſix on the left hand are called the Northerne Signes, becauſe they are contayned in that halfe of the Zodiaque, which declineth towards the North. And the other ſix on the right hand being right oppoſite to the firſt ſix, are called the Southerne Signes, becauſe they are contayned in the other halfe of the Zodiaque, declining towards the South: and againſt euery Signe is ſet his proper Character.

What diuiſions doe Aſtronomers make of the twelue ſignes?

Diuers, as followeth: for ſome are ſaid to be aſcendent, and ſome deſcendent.

Aſcendent, are thoſe that riſe from the South towards our Zenith, tending Northward, which be theſe, Capricornus, Aquarius, Piſces, Aries, Taurus, and Gemini.

The deſcendent are theſe, Cancer, Leo, Virgo, Libra Scorpio, and Sagittarius.

Againe, ſome are ſaid to bee vernall, as Aries, Taurus, and Gemini.

Some Eſtiuall, as Cancer, Leo, Virgo.

Some Autumnall, as Libra, Scorpio, and Sagittarius.

And ſome Hiemall or Brumall, as Capricornus, Aquarius, and Piſces, ſignifying the foure Seaſons of the yeare, that is to ſay, the Spring, Summer, Autumne, and Winter.

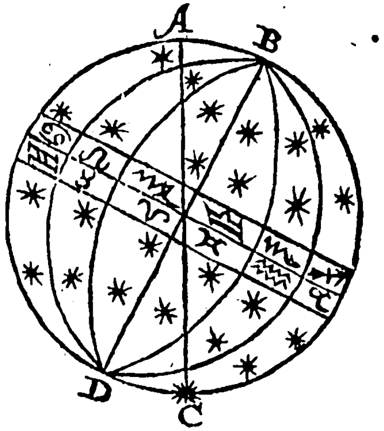
And ſome doe make diuers other diuiſions, which becauſe they appertaine to Aſtrologie rather then to the Treatiſe of a Spheare, I willingly omit them.

Now tell what breadth the Zodiaque hath, and why it is imagined to haue ſuch breadth.

It hath (according to the ancient writers) twelue degrées in breadth, that is to ſay, ſix degrees on the one ſide of the Ecliptique Line, and ſix degrées on the other ſide of the Ecliptique Line, but according to the moderne Writers, it hath ſixtéene degrées in breadth, that is, eight degrées on each ſide of the Ecliptick line, which breadth was neceſſarily imagined, firſt to the intent, that by the meaſures and degrées thereof it might be known, how much the Planets (otherwiſe called the wandring ſtarres, whoſe courſe is to paſſe continually vnder this broad Circle) do wander at any time on either ſide of the Ecliptique line, for they all wander, but ſome more, ſome leſſe, the Sunne onely excepted, which neuer ſwarueth from that line, but alwaies goeth right vnder the ſame, and therefore the ſaid line is called of ſome Writers the way of the Sun: And ſecondly, it hath ſuch breadth, to the intent it may contayn within the ſame the twelue ſignes aforeſaid, by meanes of which ſignes, the whole circuit or longitude of the ſaid circle, is diuided into twelue equall parts, and euery ſuch part is diuided into thirty degrées, and euery degrée into ſixty minutes, and euery minute into ſixty ſeconds, &c. ſo as the whole longitude thereof contayneth 360. degrées, according vnto which diuiſion, all the reſt of the Circles both greater and leſſer deſcribed in the Spheare, are made to contayne the like number of degrées, and euery halfe circle to containe 180. degrées, and euery quarter of a circle to containe ninety degrées, and by this diuiſion as well of the breadth as of the length of the Zodiaque, it appeareth that euery one of the twelue ſignes hath thirty degrées in length, and twelue degrées in breadth, and thereof the Planets, Stars, and all other Celeſtiall bodies are ſaid to haue both Longitude and Latitude, the Sunne only excepted.

How is ſuch Longitude and Latitude to be vnderſtood?

The Longitude of any Planet or Starre is to be counted in the Ecliptique line containing in circuit 360. degrées, reckoning from the firſt point of Aries, and ſo to Taurus, Gemini, and Cancer, and ſo forth according to the ſucceſſion of the ſigne, vntill you come againe vnto the firſt point of Aries, at which point ſuch longitude both endeth and beginneth. The latitude is counted from the ſaid Ecliptique line towards any of the Poles of the Zodiaque. And hereof looke how many degrées any fixed Star or Planet is diſtant from the Ecliptique line towards any of the ſaid Poles, ſo much latitude it is ſaid to haue, either Northerne or Southerne: moreouer, by this diuiſion of the ſignes, the whole firmament is diuided into twelue parts, by reaſon of the ſixe circles, called the circles of poſition, imagned to paſſe through the Poles of the Zodiaque, and alſo through the beginning of euery ſigne, whereby we know vnder what ſigne euery Starre is ſituated, though it bée cleane out of the Zodiaque, as this Figure héere plainely ſheweth, marked with theſe Letters, A. B. C. D. A. ſignifieth the North-pole of the world, B. the North-pole of the Zodiaque, C. the South-pole of the World, D. the South-pole of the Zodiaque.



CHAP. XII.

How much the Zodiaque declineth from the Equinoctiall towards either of the Poles, and of the greateſt declination of the Sunne, what it is at this preſent, and what it hath beene in times paſt.

YOu haue to vnderſtand that the Zodiaque, or rather the Ecliptique line, declineth from the Equinoctiall towards eyther of the Poles, thrée degrées, 30′. and that is ſaid in theſe dayes to bee the greateſt declination of the Sunne, which declination is two-fold, that is,

Northerne

Northerne and Southerne, for like as the Sunne entring into the firſt point of Aries, beginneth then to decline from the equinoctiall Northward, to the quantity of 23. degrées and 30′: ſo entring into the firſt point of Libra, hee declineth againe from the equinoctiall as much Southward. And note by the way, that by reaſon of this ſlow motion, when hee is in the Northerne ſignes, he ſpendeth ſeuen dayes, and ⅕ of a day, more in making his North declination, then in making his South declination, becauſe he is then in his ſwift motion, and the time hath béene, that he hath ſpent aboue ten dayes more in making his North declination, then in making his South declination: neither is the greateſt declination of the Sunne in all Ages of like quantitie. For in Ptolomies time it was 23. degrées, 5′1. and 20″, euer ſince whoſe time it hath alwaies continually decreaſed vntill this preſent, ſo as now the greateſt declination is no more but 23. degrées and 30′. And Copernicus maketh the declination of the Sunne, in reſpect of quantity to be two-fold, that is, greateſt and leaſt, affirming the greateſt to bee 23. degrées and 5′2. and the leaſt to bee 23. degrées and 2′8. as it is now counted, the difference whereof is 2′4. and whileſt the Ecliptique departeth from the Equinoctiall, and turneth againe towards the Equinoctiall, there doe runne (as he ſaith) 3434. yeares.

CHAP. XIII.

How to know the quantitie of the Sunnes declination, bee it Northward or Southward, euery day throughout the yeare, as well by a Table as by helpe of the Spheare.

THis is chiefly to bee knowne by Tables calculated of purpoſe, which Tables moſt commonly are either made to anſwere euery day of the moneth, or elſe to the degrée of the ſigne wherein the Sunne is euery day, which kind of Table is contayned in leſſer roome then the other: but to worke by ſuch a Table, you muſt firſt know in

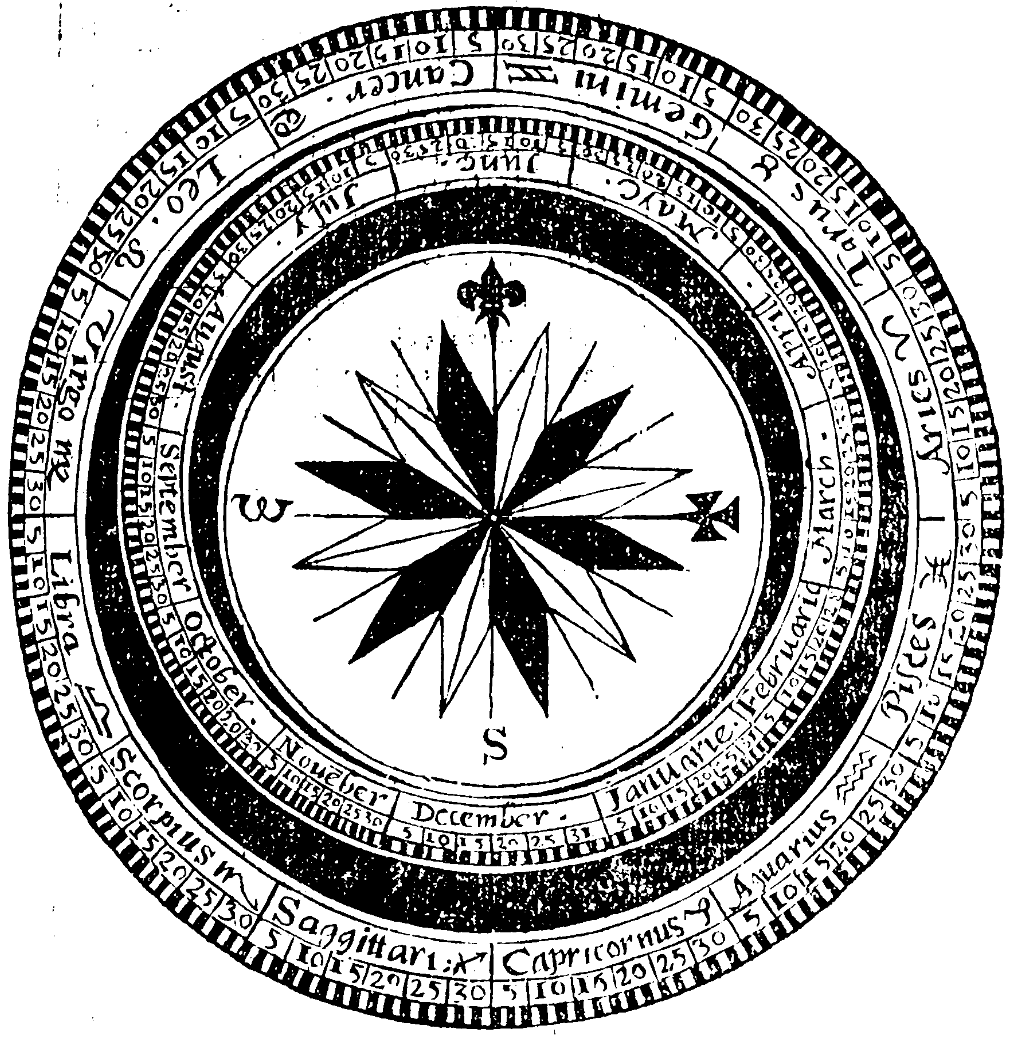
what

what Signe and Degree the Sunne is euery day.

How is that to be done?

It is to be knowne moſt truly by the Ephemerides, or ſuch like Table calculated of purpoſe, ſhewing not onely the degree of the ſigne, but alſo the verie minute wherein the Sunne is euery day, and for want of ſuch a Table, you may without conſideration of the minutes, know it by ſuch an inſtrument or Figure as this following, which conſiſteth of diuers Circles, whereof the outermoſt contayneth the degrees of the twelue ſignes, together with the names of the ſaid ſignes, and the next the dayes of each moneth, together with the names of the ſaid moneths, much like the back-ſide of an Aſtrolabe, in the center or middeſt of which figure or Inſtrument is a threed, which if you lay vpon the day of the Moneth which you ſeeke, it will ſtraight direct you to the degree of the ſigne wherein the Sun is that day; as for example, if you would know in what ſigne and degree the Sunne is the fourth of May, then by drawing the threed right vpon the ſaid day ouer and beyond the outermoſt circle, you ſhall find that it will fall right vpon the 23. degree of Taurus.

An Inſtrument to know thereby in what Signe and degree the *Sunne is euery day throughout the Yeare.*



Then hauing found the degree of the Sunne, you muſt reſort therewith to this Table following, made for the declination of the Sunne.

A Table ſhewing the declination of the Sunne euery day throughout the yeare.

Degtees of the ſignes.	♈ ♎			♉ ♏			♊ ♐			Degrees of the ſignes.
	D.	M.	S.	D.	M.	S.	D.	M.	S.	
1	0	23	57	11	51	48	20	25	57	29
2	0	47	53	12	12	41	20	28	59	28
3	1	11	49	12	33	21	20	49	9	27
4	1	35	44	12	53	50	21	1	15	26
5	1	59	37	13	13	5	21	12	28	25
6	2	23	28	13	34	8	21	23	8	24
7	2	47	18	13	52	57	21	43	23	23
8	3	11	4	14	13	32	21	43	15	22
9	3	34	48	14	32	53	21	52	47	21
10	3	58	28	14	51	59	22	1	45	20
11	4	22	5	15	10	51	22	10	22	19
12	4	45	37	15	29	27	22	18	35	18
13	5	9	5	15	47	47	22	26	22	17
14	5	32	29	16	5	52	22	33	44	16
15	5	55	47	16	23	38	22	40	40	15
16	6	18	59	16	41	9	22	47	10	14
17	6	42	6	16	58	22	22	53	14	13
18	7	5	6	17	15	18	22	58	52	12
19	7	28	0	17	31	56	23	4	3	11
20	7	50	7	17	48	15	23	8	48	10
21	8	13	36	18	4	16	23	13	6	9
22	8	35	38	18	19	48	23	16	57	8
23	8	58	21	18	35	20	23	20	21	7
24	9	20	36	18	50	22	23	23	18	6
25	9	42	42	19	5	5	23	25	48	5
26	10	4	38	19	19	26	23	27	51	4
27	10	26	25	19	33	27	23	29	27	3
28	10	48	2	19	47	7	23	30	35	2
29	11	9	28	19	59	59	23	31	16	1
30	11	30	44	20	13	22	23	31	30	0
D.	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.
	♍ ♓			♌ ♒			♋ ♑			

The deſcription and vſe of the Table.

THis Table conſiſteth of fiue Columnes, whereof the firſt on the left hand, and the laſt on the right hand, do containe the degrées of the twelue ſignes of the Zodiaque, coũting from one to thirtie. And the thrée middle columnes doe containe the degrées, minutes, and ſeconds of declination ouer the head, of which thrée middle columnes, are ſet downe the Characters of theſe ſix oppoſite ſignes, Aries and Libra, Taurus and Scorpio, Gemini and Sagittarius, and at the foote of the ſaid middle columnes are ſet downe the Characters of the other ſixe oppoſite ſignes, that is, Virgo and Piſces, Leo and Aquarius, Cancer and Capricornus: for euery two oppoſite ſignes, as well aboue as beneath, haue like declination, the vſe of which Table is thus. Firſt hauing found out the degrée of the Sunne by the Inſtrument before deſcribed, or rather by ſome true Ephemerides, you muſt ſéeke out the number of the ſaid degrée, either in the firſt or laſt columne, according as the Character of the ſigne is placed. For if the ſigne or character be aboue, then you muſt ſéeke for the ſaid number in the firſt columne on the left hand, which numbers do deſcend from one to thirtie; but if the ſigne bee beneath, then you muſt finde it out in the outermoſt columne on the right hand, the numbers whereof do aſcend from one to thirty, and the common Angle or ſquare, ſtanding right againſt the ſaid number, will ſhew you the degrée, minutes, and ſeconds of the declination: As for example, hauing found by the former Inſtrument that the fourth day of May the Sun is in the 23. degrée of Taurus, I ſéeing the Character of Taurus to ſtand aboue, doe ſéeke my foreſaid number of 23 degrées in the firſt columne on the left hand, and in the common Angle or ſquare right againſt that number, and vnder the ſigne Taurus, I find the declination of the Sunne to be eightéene degrées 35′. and 20″. But this Table cannot ſerue alwayes: yea rather ſuch Tables as are to be renued, as our Aſtronomers ſay euery thirty yeares. Alſo you may know the daily declination of the Sun, by helpe of the material Spheare or Globe: thus hauing ſet the Spheare at your Latitude, bring the degree of the

the ſigne wherein the Sun is that preſent day vnto the moueable Meridian, and ſtaying it there, marke whether it falleth on the South ſide or on the North ſide of the Equinoctiall: for if it be in any of the Northerne ſignes, it will fall on the North ſide of the Equinoctiall, and if it bee in any of the Southerne ſignes, it will fall on the South ſide of the Equinoctiall, and by counting the degrées vpon the Meridian, contained betwixt the degrée of the Sunne and the Equinoctiall, you ſhall know what declination the Sunne hath that day, as for example, in the Latitude 52. in the yeare 1590. the fifth day of May, I finde the Sunne by the Ephemerides, to be in the 23. degrée and 48′. of Taurus, which point I bring to the moueable Meridian and there ſtaying it, I find that point to bee diſtant from the Equinoctiall Northward, eightéene degrées and certaine minutes, and ſo much of North Declination I conclude the Sunne to haue that day.

CHAP. XIIII.

Vpon what Poles the Zodiaque turneth about, alſo of the Eccliptique line, and of the diuers vſes thereof.

THe Zodiaque turneth about vpon his owne proper Poles from Weſt to Eaſt, whereof the one being placed in the Colure of the Solſtices towards the North, is diſtant from the Pole Arctique 23. degrées, and 30′. and the other is placed in the ſaid Colure towards the South, being of like diſtance from the pole Antarctique, whereof the Aſtronomers haue a generall Rule, affirming that the diſtance of the two Poles of the World, from the Poles of the Zodiaque, is alwayes equall to the greateſt declination of the Sunne, which as hath béene ſaid before, is 23. degrées and 30′. as you may plainly ſée by the Spheare. And note that theſe two Poles are otherwiſe called the Poles of the Ecliptique, for in conſidering the declination of the Sunne or of the Zodiaque from the Equinoctiall, you muſt haue reſpect onely to the Ecliptique Line, which is in the middeſt of the Zodiaque, and not to any other part of the Zodiaque. And as the Equinoctiall line ſheweth the mouing of the firſt moueable, which is from Eaſt to Weſt, ſo the Ecliptick Line ſheweth the mouing of the ſecond moueable, which is from Weſt to Eaſt, cleane contrary to the firſt moueable, the cauſes whereof haue beene before declared.

What other vſes hath this Line more then you haue alreadie declared?

It hath diuers, for in this Line or Circle are noted the degrées, wherewith any ſtar riſeth or goeth downe, either rightly or obliquely, for all the apparances of the Heauens are chiefly referred to this circle. Againe, by this circle the chiefeſt diſtinctions and parts of times, as yeares and moneths, are knowne, and alſo the foure Seaſons of the Yeare, as Spring, Summer, Autumne, and Winter: Moreouer, the obliquitie of this circle vnder which the Sunne contitually walketh, is cauſe that the dayes both naturall and artificiall are vnequall. Finally, this circle doth ſhew the places and times of the Eclipſes both Solar and Lunar, from whence this Line taketh his name, of which Eclipſes we minde héere briefly to treate.

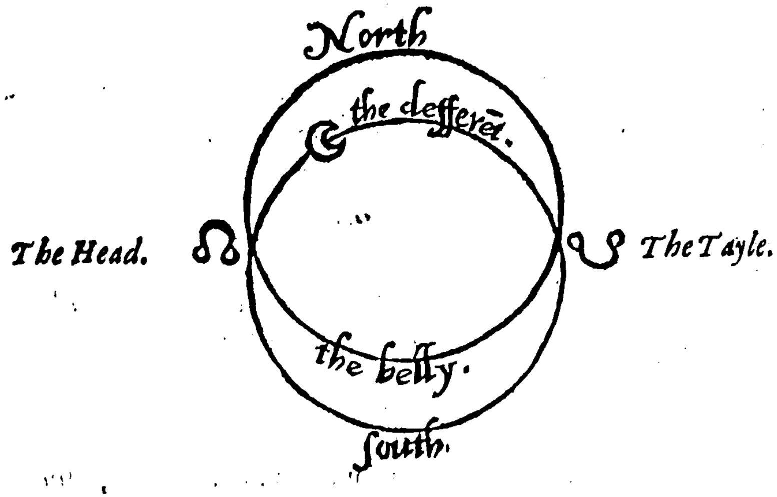
CHAP. XV.

Of the Eclipſes both Solar and Lunar, and of the head and tayle of the Dragon, with certayne Figures ſhewing the ſame.

WHat ſignifieth this word Eclipſes?

It is as much to ſay, as to want light, and to bee darkened or hidden from our ſight, as when the Sunne and Moone are both at one ſelfe-time right vnder the Equinoctiall Line, the one of theſe two lines moſt commonly is eclipſed and darkned: for there bee two Eclipſes, the one of the Sun, and the other of the Moone, but ſith that neither the eclipſe of the Sun or of the Moone doth chance, but when they meet either in the head or tayle of the Dragon, I thinke it good to ſhew firſt what is meant by the head and tayle of the Dragon. The Dragon then ſignifieth none other thing but the interſection of two Circles, that is to ſay, of the Ecliptick & of the Circle that carrieth the Moone, called her Defferent, cutting one another in two points, whereof that interſection which is Weſtwards, when as the Moone goeth towards the North, is called the head, and that which is Eaſtwards, when the Moone goeth towards the South is called the taile, marked with ſuch Characters as you ſee in the figure following, and that part towards the South is called of ſome the belly of the Dragon. And note that the Defferent of the Moone is at no time diſtant from the Ecliptique aboue fiue degrees at the moſt.

The figure of the Dragon.



This being preſuppoſed, I will ſpeake firſt of the Eclipſe of the Moone, and then of the Sunne, both which may bee eclipſed either totally or in part.

When is the Moone ſaid to be totally eclipſed?

When the Sun and Moone are oppoſite one to the other dia-

metrally,

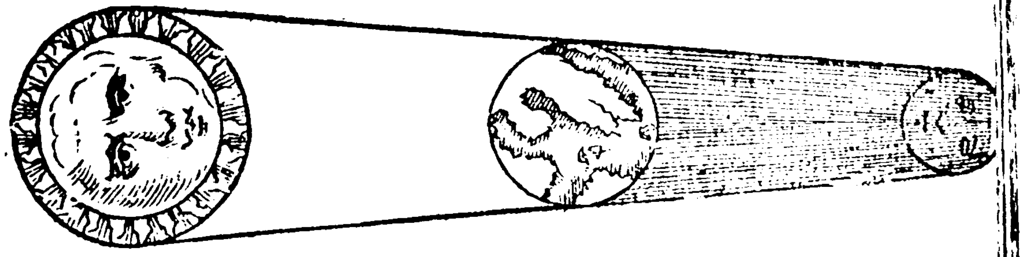
metrally, and the Earth in the very middeſt betweene them both: for the body of the earth being thick and not tranſparent, caſting his ſhadow to that point which is oppoſite to the place of the Sun, will not ſuffer the Moone to receiue any light from the Sunne, from whom ſhe alwayes borroweth her light.

At what time is the Moone ſaid to bee diametrally oppoſite to the Sunne?

When a right line drawne from the center of the Sunne, to the center of the Moone, paſſeth through the center of the earth: and note that euery time that ſhee is at the full, ſhee is oppoſite to the Sunne, and yet the earth is not at euery ſuch full diametrally betwixt her and the Sunne, for then ſhe ſhould bee eclipſed at euery full, which indeed cannot bee, but when ſhee is either in the head or tayle of the Dragon.

When is the Moone ſaid to be eclipſed in part?

When the Sunne, the Earth, and the Moone bee met in one ſelfe diametrall line, but the Moone is declining either on the one ſide or on the other, as you may plainly ſee by this figure following.



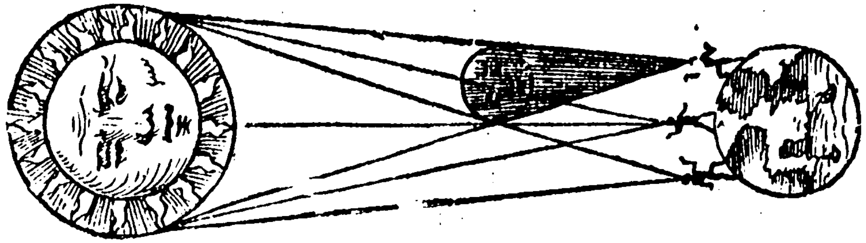
But note that the Eclipſes of the Moone may be vniuerſal, becauſe the Earth is farre bigger then the Moone, and thereby able to ſhadow her whole body.

When is the Sunne ſaid to be eclipſed?

When the Moone is betwixt the Sun and the Earth, which chanceth in a Coniunction, & yet not in euery coniunction, but when it falleth either in the head or tayle of the Dragon, which

may

may chance, as I ſaid before, either totally or in part: totally I ſay, in reſpect of thoſe parts of the earth whereon the ſhadow directly falleth. For ſith the Moone is far leſſer then the Earth, ſhe cannot ſhadow all the Earth, and therefore the Eclipſe of the Sunne cannot bee vniuerſall, but yet to ſome parts of the Earth totally, and to ſome partly, and to other ſome nothing at all, as you may plainly ſee by this figure following.



Yet all the Hiſtories doe affirme that the Eclipſe of the Sun was vniuerſall at the death of Chriſt.

Yea, that was miraculous, and alſo it was then at the full of the Moone, which was alſo as miraculous: and therefore Dionyſius a Senator of Athens, beholding that Eclipſe, cryed out, ſaying theſe words, Either God this day ſuffereth, or elſe the World muſt needs periſh for euer: which Dionyſius was the firſt that conuerted the Frenchmen to the Faith of Chriſt, doing there great Miracles, in honour of whom was erected the rich Abbey of Saint Denis, not farre from Paris, whereas the Kings and Princes of France were wont to be buried.

How is it to bee proued that the Eclipſe at Chriſt his death, was at the full of the Moone?

As well by ancient Hiſtorie, as by Saint Auguſtine, who ſaith that the Iewes were wont to keepe their feaſt of Paſſeouer (at which time Chriſt ſuffered) alway at the full of the Moone.

If the Sunne and Moone be eclipſed but in part, how are ſuch parts to be accounted?

By the parts of the Diameter of the bodies of thoſe two Planets, for the Aſtronomers do diuide the Diameter as well of the Sunne, as of the Moone, into 12. and ſome into 24. parts,

which they call points, and therefore are wont to ſay, that the Sunne or Moone are darkened or eclipſed ſeuen points, eight points, nine points, &c.

CHAP. XVI.

Of the two Colures, and why they are ſo named, and whereto they ſerue: alſo of the foure Cardinall points, that is, of the two Equinoctiall, and the two Solſtitiall points, and of the entrance of the Sun into any of thoſe points, or into any other ſigne.

WHat be Colures?

They bee great mooueable Circles paſſing through both the Poles of the World, which the Aſtronomers doe otherwiſe call circles of declination, whereof they make 180. which are halfe ſo many as the be degrees in the Equinoctiall, applying them to diuers vſes not needfull heere to be rehearſed: for ſith that there are but two Colures accuſtomably ſet downe in the Spheare, without the which a materiall Spheare cannot bee made, I minde heere therefore only to treate of them.

Shew firſt what this name Colure ſignifieth.

This word Colure being compounded of Colos and Oura, is as much to ſay, as vnperfect or maymed, the taile being cut off, becauſe none of thoſe circles are euer ſeen whole aboue our Horizon, but part thereof, for ſome part is alwayes ſeene, and ſome part is alwayes hidden, as that part which is aboue the Horizon, and nigh vnto the Pole, is alwayes ſeene, becauſe it neuer goeth downe vnder the Horizon: likewiſe that which is nigh vnto the South Pole is alwayes hidden from vs, becauſe it neuer riſeth aboue our Horizon, as by turning the Spheare about, you may eaſily perceiue the ſame.

Which bee thoſe Colures that are commonly ſet downe in the Spheare, and how are they named?

They are two great moueable circles, paſſing through the Poles of the World, croſſing one another in the ſaid Poles with right Sphearicall Angles, by meanes whereof they diuide the whole Spheare into foure equall parts, of which two Colures, the one is called the Colure of the Equinoxes, and the other the Colure of Solſtices.

Deſcribe theſe two Circles, and ſhew why they are ſo named.

The Colure of the Equinoxes is ſo called, becauſe it cutteth the Zodiaque in the beginning of Aries, which is called the vernall Equinox: and alſo in the beginning of Libra, which is called the Autumnall Equinox, at which two times the dayes and nights bee equall, as hath beene ſaid before when wee did ſpeake of the Equinoctiall Circle, and this Circle diuideth the Ecliptique into two halfes, the one Septentrionall, and the other Meridionall, and thereby ſheweth the Signes wherin the Sunne maketh the dayes longer and ſhorter then the nights: for whileſt hee is in the ſix Northerne Signes, hee maketh the dayes with vs longer then the nights: and when hee is in the ſix Southerne Signes, hee maketh the nights longer then the dayes. Now you haue to vnderſtand that the Colure of the Solſtice, is ſo called, becauſe it cutteth the Zodiaque in the two Solſtitiall points, that is to ſay, in the beginning of Cancer, and the beginning of Capricorne, as you may ſee in beholding and turning the Spheare about with your hand.

Why are theſe two points called Solſtitiall?

They take their name of theſe two Latine words Sol and ſtatio, that is to ſay, the Sunne, and ſtanding, for when the Sunne is in any of the two points, he ſeemeth to ſtand ſtill, or at the leaſt moueth ſo little, as his proper mouing from Weſt to Eaſt cannot be eaſily perceiued, during the ſpace of twelue dayes. And you haue to note, that when the Sunne entreth into the firſt degree of Cancer, which is about the twelfth of Iune, then he is at the higheſt, and the dayes be at the longeſt, and therefore, it is called the Summer Solſtice. Againe, when he entreth into the firſt degree of Capricorne, which is about the twelfth of December, then the Sunne is at the loweſt, and the nights are at the longeſt, and therefore it is called the Winter

Solſtice. And in this Colure there are ſet downe the two Poles of the Ecliptique line, being diſtant from the Poles of the world three and twenty degrees and 2'8. Moreouer, on this Colure meaſured is the greateſt declination of the Sunne, which is alwayes equall to the diſtance of the Pole of the Ecliptique, from the Pole of the World, as hath beene ſaid before. And you haue to note that the foure former points, that is to ſay, the two Equinoxes, and the two Solſtices, are commonly called the foure cardinall or principall points, and of ſome they are called the foure points of Change, ſignifying the foure beginnings of the foure diuers Seaſons of the Yeare: for betwixt the beginning of Aries, and the beginning of Cancer, is contained the Spring-time, and betwixt the beginning of Cancer and the beginning of Libra is the Summer time: and from the beginning of Libra to the beginning of Capricorne, is the time called Autumne, or fall of the Leafe: and from the beginning of Capricorne to the beginning of Aries, is contayned the Winter ſeaſon, albeit the Sunne entreth not into any of theſe Signes alwayes at one ſelfe day or time of the Yeare: for at Chriſt his Incarnation, the Sunne entred into Aries the fiue and twentieth day of March, and into Cancer the foure and twentieth of Iune, and into Libra the ſeuen and twentieth of September, and into Capricorne the fiue and twentieth of December, which was then the ſhorteſt day in the Yeare, and the beginning of Winter, and therefore is called of the Latines dies brumalis, on which day Chriſt our Sauiour was borne, ſo as from the time of his birth vnto this preſent yeare, there are runne almoſt thirteene dayes, wherefore, vnleſſe the Kalenders be reformed as wel heere in England as elſewhere (for the Roman reformation is not ſo exactly true as it might be) we ſhall haue in proceſſe of time, the Spring in Winter, and the Winter in Autumne.

1·3·5·7 9
2 4 6 8 0
11·02 5·9

How ſhall I know this preſent Yeare, or any yeare to come hereafter, at what day and houre the Sunne entereth into any of the twelue Signes?

First, you muſt learne by ſome good Ephemerides, or other Table, the true entrance of the Sunne into euery Signe in any yeare paſſed before, then from the time of the entrance of the Sunne into the Signe which you deſire to know, conſider how many yeeres are betwixt, and how many leape yeares are in the ſame contayned, and ſubtract for ſo many times as there be leape yeares, 4′4. of an houre, and adde to the houres remayning, ſo many times fiue houres, and 4′9. as there bee yeeres remayning ouer and beſides the leape yeere, and that ſumme ſhall ſhew you the day, houre, and minutes of the true entrance of the Sunne into that Signe in the ſame yeare that you deſire to know.

CHAP. XVII.

Of the Horizon both right and oblique, making thereby three kinds of Spheares, that is, the right, the parallell, and the oblique Spheare.

WHat is the Horizon?

It is a great immoueable Circle which diuideth the vpper Hemiſpheare, which is as much to ſay, as the vpper halfe of the World which wee ſee, from the nether Hemiſpheare which we ſee not: for ſtanding in a plaine field, or rather vpon ſome high mountayne void of buſhes and trees, and looking round about, you ſhall ſee your ſelfe enuironed, as it were, with a Circle, and to be in the very middeſt or center thereof, beneath or beyond which Circle, your ſight cannot paſſe, and therefore this Circle in Greeke is called Horizon, and in Latine Finitor, that is to ſay, that which determineth, limiteth or boundeth the ſight; the Poles of which Circle are imagined to be two points in the firmament, whereof the one ſtandeth right ouer your head, called in Arabick Zenith: and the other directly vnder your foot, called in the ſame tongue Nadir, that is to ſay, the point oppoſite, and from point to point you muſt imagine that there goeth a right line paſſing through the

the

the center of the World, and alſo through your body both head and feete, which is called the Axle-tree of the Horizon, and you haue to vnderſtand that of Horizons there be two kinds, that is, right and oblique, making three kinds of Spheares, that is to ſay, the right Spheare, the parallell Spheare, and the oblique Spheare.

When is the Horizon ſaid to be right, and thereby to make a right Spheare?

It may be ſaid to be right two manner of wayes, firſt, when the Horizon paſſeth through both the Poles of the World, cutting the Equinoctiall with right Angles, in which Spheare they that dwell haue their Zenith in the Equinoctiall, which paſſeth right ouer their heads, to whom the dayes and nights are alwayes equall. Secondly, they are ſaid to haue a right Horizon, and to dwell in a right Spheare, to whom one of the Poles of the World is their Zenith, and their Horizon is all one with the Equinoctiall, cutting the Axle-tree of the World in the very middeſt with right Angles; and becauſe the Horizon and the Equinoctiall are parallels, this kind of Spheare is called a parallell Spheare, in which Spheare they that dwell haue ſix monethes dayes, and ſix monethes nights, as you may eaſily perceiue by placing the Spheare, ſo as one of the Poles may ſtand right vp in the middeſt of the Horizon, by meanes whereof you ſhall ſee ſix ſignes of the Zodiaque to be alwayes aboue the Horizon, and ſix ſignes to bee alwayes vnder the Horizon: Againe, by placing the Spheare ſo as both the Poles may lye vpon the Horizon, you ſhall ſee the ſhape of the firſt right Spheare, wherein the Horizon paſſeth through both the Poles of the World, and the Equinoctiall paſſeth through the Poles of the Horizon, which are the two points called before the Zenith and Nadir.

When is it ſaid to bee an oblique Horizon, and thereby to make an oblique Spheare?

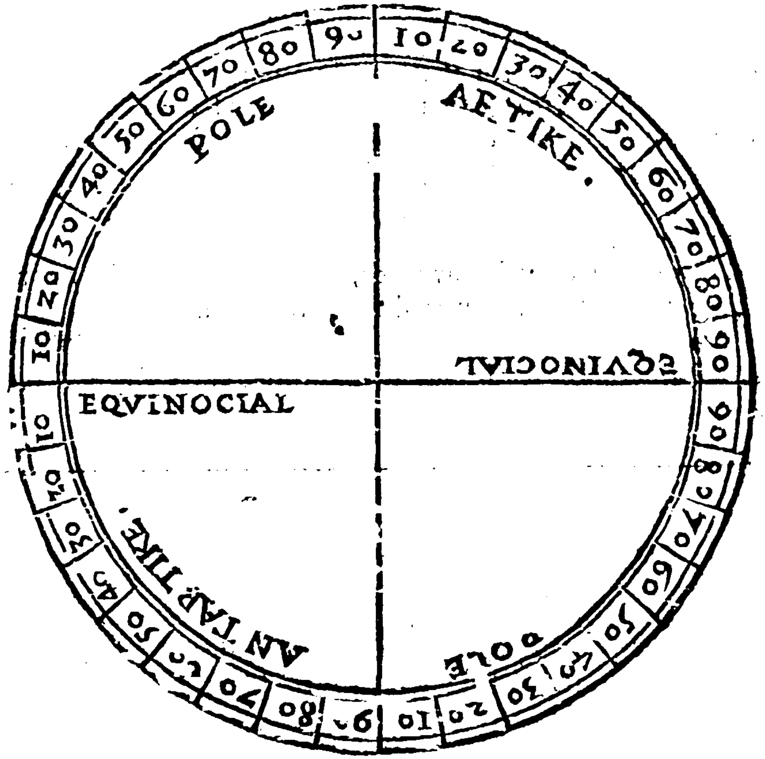
When the Pole of the World is eleuated aboue the Horizon, be it neuer ſo little, ſo as the Horizon do cut the Equinoctiall with oblique Angles, and looke how much the Pole of the World is eleuated aboue your Horizon, ſo much is your

Zenith

Zenith diſtant from the Equinoctiall, and the nigher that your Horizon approcheth to the Pole, the nigher your Zenith approcheth to the Equinoctiall. Againe, looke how much the Equinoctiall is eleuated aboue your Horizon, ſo much is your Zenith diſtant from the Pole, all which things this figure here following doth plainly ſhew, whereby you may eaſily perceiue that the Latitude, which is the diſtance of your Zenith from the Equinoctiall, is alwayes equall to the Latitude of the Pole, which is the diſtance betwixt your Horizon and the Pole, as for example; knowing the Latitude of Norwich to be two and fifty degrees; lay the Zenith of this figure vpon the two and fiftie degrees, reckoning from the Equinoctiall towards the Pole Arctique on your left hand, and looke what diſtance is betwixt the ſaid Zenith and the Equinoctiall, the ſelfe-ſame diſtance you ſhal find to be betwixt the Horizon and the fore-ſaid Pole on your right hand: and you may doe the like vpon the Spheare itſelfe, by rayſing the moueable Meridian aboue the Horizon at that Altitude, ſo as the two and fiftie degrees may be euen with the Horizon.

A

A Figure ſhewing the Latitude of any place to bee *equall to the eleuation of the Pole.*



What

What other vſes hath this Circle?

In this circle are ſet downe the foure quarters of the world, as Eaſt, Weſt, North, and South, and the reſt of the windes: Againe, this circle diuideth the artificiall day from the artificiall night, for all the while that the Sunne is aboue the Horizon it is day, & whileſt it is vnder the ſame it is night. And by this Circle we know what ſtars doe continually appeare, and which are continually hidden, alſo what ſtars doe riſe and goe downe. Againe, in taking the eleuation of the Pole, this circle is chiefly to be conſidered, for when wee know how many degrees the Pole is rayſed aboue the Horizon, then we haue the eleuation thereof for that place. For to euery ſeuerall place, yea to euery little moment of the earth, in an oblique Spheare, belongeth his proper Horizon and ſeuerall Altitude of the Pole, whereby it appeareth that the Horizons are infinite and without number.

How ſhall I know in any place, hauing an oblique Horizon, how much the Pole is eleuated aboue the Horizon?

That is declared in the ſecond Book of this Treatiſe, whereas I ſpeake of the Latitude and Longitude of the Earth, in the eight Chapter.

CHAP. XVIII.

Of the Meridian, and of the vſes thereof.

WHat is the Meridian?

It is a great immooueable Circle paſſing through the Poles of the World, and through the Poles of the Horizon.

Why is it called the Meridian?

Becauſe that when the Sun riſing aboue the Horizon in the Eaſt, commeth to touch this line with the Center of his bodie, then it is mid-day or noon-tide to thoſe, through whoſe Zenith that Circle paſſeth. And when the Sun after his going downe in the Weſt commeth to touch the ſelf-line againe in the point oppoſite, it is to them mid-night. And note that diuers Cities,

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hauing diuers Latitudes, that is to ſay, being diſtant one from another North and South, bee it neuer ſo farre, may haue one ſelfe Meridian: but if they bee diſtant one from another Eaſt and Weſt, bee it neuer ſo little, then they muſt needs haue diuers Meridians, and ſuch diſtance betwixt the two ſeuerall Meridians, is called the difference of Longitude, whereof wee ſhall ſpeake hereafter more at large, when we come to treat of the Longitude and Latitude of the earth, which ſomething differeth from the Longitude and Latitude of the Stars or Planets, whereof we haue alreadie ſpoken in the eleuenth Chapter.

How many Meridians be there?

The Aſtronomers doe appoint for euery two degrees of the Equinoctiall a Meridian, ſo as they make in all 180. Albeit moſt commonly in the Spheare they ſet downe but one, which ſerueth for all by turning the bodie of the Spheare to it, which for that cauſe is called the mooueable Meridian. And in ſuch Spheares as haue not a foot and a ſtanding Horizon, there is no Meridian at all, but the two Colures are faine to ſupply their want, but all terreſtriall Globes are commonly deſcribed with twelue Meridians, cutting the Equinoctiall in 24. points, and diuiding the ſame into 24. ſpaces, euery ſpace contayning fifteene degrees, which is an houre, by meanes whereof wee know how much ſooner or later it is noon-tide in any place, for it is noon-tyde ſooner to thoſe whoſe Meridian is more Eaſtward, then to them whoſe Meridian is more Weſtward. And contrariwiſe the Eclipſe of the Sun or Moone appeareth ſooner to thoſe, whoſe Meridian is more Weſtward.

What other vſes hath this Circle?

This Circle diuideth the Eaſt part of the World from the Weſt, and alſo it ſheweth both the North and South, for by turning your face towards the Eaſt, you ſhall find the Sunne being in that Line at noon-tyde to bee on your right hand right South, yͤ oppoſite part of which Circle ſheweth on the left hand the North. Alſo this Circle, by reaſon that it paſſeth through both the Poles of the World, diuideth both the Equinoctiall & all his Parallels into two equal parts, as wel aboue the Horizon, as vnder the Horizon, & by that meanes it diuideth the arti-

ficiall

ficiall day and artificiall night, each of them into two partes, that is to ſay, into two ſemidiurnall, and into two ſeminocturnall parts. For betwixt that part of the Horizon where the Sunne riſeth, mounting ſtill vntill hee come to this Circle, which is at noone-tyde, is contayned the firſt halfe of the day, and the other halfe is from the ſame circle to the going downe of the Sunne vnder the Horizon. And the firſt part of the night is the ſpace betwixt the Sunnes going downe and his comming againe to the Meridian, which is at mid-night, and from thence to the time of his riſing is the other halfe of the night: and alſo the Aſtronomers take the beginning of their naturall day from this Circle, counting either from noon-tyde to noone-tyde, or elſe from mid-night to mid-night. Againe, this Circle ſheweth the right aſcentions and declinations of the ſtars, and the higheſt altitude, otherwiſe called the Meridian altitude of the Sunne or of any ſtarre, or degrée of the Ecliptique, or of any other point in the Firmament: all which vſes and many others more you ſhall better vnderſtand hereafter, when wee come to ſhew the vſes of the Globe, as well Terreſtriall as Celeſtiall.

CHAP. XIX.

Of the verticall Circles, and vſes thereof.

But hére you haue to note, that though the moſt part of Geographers doe ſet downe in their Spheares but ſix great circles, yet there is another great Circle called the Circle Verticall, which paſſeth ouer our heads, through our Zenith, whereſoeuer we be vpon the Land or Sea croſſing our Horizon in two points oppoſite, and diuiding the ſame into two equall parts, and ſuch kind of circles are called in Arabick Azimuthes, whereof you may imagine that there be ſo many as there be rombes or winds in the Mariners Cõpaſſe, which are in number 32. yea and if you will, you may make halfe ſo many as there be degrées in the Horizon, which are in number 360. the halfe whereof is 180. If you be right vnder the Equinoctiall, and doe go or ſaile right Eaſt or Weſt, then the Equinoctiall is your verticall circle, and if you goe or ſaile right North or South, then the Meridian is your verticall circle, which two circles notwithſtanding doe alwayes kéepe their names. But in ſayling by any other Rombe, that circle which is imagined to paſſe from the true Eaſt-point right ouer your head vnto the true Weſt-point, or which croſſeth your Meridian in the Zenith point with right Sphearicall Angles, is moſt properly called the vertical circle: and the learned Seamen haue great reſpect to two ſpeciall kinds of verticall Circles, that is, the Magneticall Meridian, and the Azimuth of the Sunne.

What manner of verticall circles be thoſe, and whereto ſerue they?

M. Borrough in his Diſcourſe of the variation of the Compaſſe, defineth the Magneticall Meridian to be a great Circle, which paſſeth through the Zenith, and the Pole of the Loadſtone called in Latine Magnes, and diuideth the Horizon into two equal parts, by croſſing the ſame into two points oppoſite. Againe, the Azimuth of the Sunne is a great Circle, paſſing through the Zenith, and the center of the Sun in what part of the Heauen ſoeuer he be, ſo as he be aboue the Horizon, which Circle diuideth the Horizon into two equall parts, by croſſing the ſame into two points oppoſite. And by helpe of theſe two Circles and a certaine Inſtrument made of purpoſe to giue a true ſhaddow, he teacheth to find out the true Meridian of any place: and alſo to know how much any Mariners Compaſſe doth varie from the true North and South, in North-eaſting or North-weſting, whereof I ſhall ſpeake more at large hereafter in my Treatiſe of Nauigation.

What vſe is there of the verticall Circles, or Azimuthes?

The verticall circle ſheweth what time the Sunne or any other ſtar riſing beyond the true Eaſt-point, is paſſed that Eaſt-point, as alſo when the Sunne or ſaid ſtarre, commeth to the true Eaſt or any other Rombe. Alſo in what Coaſt or part of

Heauen, the Sunne, Moone, or any other ſtarre is at any time being mounted aboue the Horizon, as whether it be Southeaſt or Northeaſt, or in any other Rombe: Alſo by helpe of the verticall Circle moſt properly ſo called, are the twelue Houſes of Heauen ſet, according to Campanus and Gazula. And by helpe of theſe Circles, you may alſo know how any place vpon the Earth beareth one from another eyther Eaſtward or Weſtward, and ſo forth, for euery place hath his ſeuerall Azimuth anſwerable to the Horizon and Zenith of the ſaid place.

Of certayne Circles called Almicanterathes.

Since I haue ſpoken heere ſome-what of the verticall circles called Azimuthes, it ſhall not be amiſſe, to ſhew you alſo that there be other circles to be conſidered of in the Spheare, as wel as in the Aſtrolable, called Almicāterathes, that is to ſay, circles of Altitude, which though they be not all great circles, for euery one is leſſer then other, proceeding from the oblique Horizon of any place to the Zenith of the ſaid place, yet the firſt Almicanterath which is the very oblique Horizon it ſelfe, is a great Circle diuiding the Spheare into two equall parts, and all the reſt are leſſer and leſſer, vntill you come to the very Zenith, and are parallels to the Horizon, euen as the Tropiques and the other leſſer Circles are parallels vnto the Equinoctiall. And the Zenith, in Sphericall bodies, is the center of them all, though it be not ſo in Aſtrolabes, for there euery Almicanterath is faine to haue his ſeuerall center, of which circles there be in al ninety, according to the number of ninety degrees, contayned betwixt the oblique Horizon and the Zenith, and theſe circles do ſerue to ſhew the altitude of the Sunne or Moone, or of any other ſtarre fixed or wandring, being mounted at any time aboue the oblique Horizon, which is eaſie to be found by any Quadrant, Croſſe-ſtaffe, or Aſtrolabe: but leauing to ſpeake any further of theſe circles, becauſe they are not vſed to be deſcribed in Spheares, but only in Aſtrolabes, I will now treate of the foure leſſer Circles, before mentioned, which are commonly ſet downe in euery Spheare or Globe.

CHAP.

CHAP. XX.

Of the foure leſſer circles, that is to ſay, the circle Arctique, the circle Antarctique, the Tropique of Cancer, *and the Tropique of* Capricorne, *and alſo of the fiue Zones, that is to ſay, two cold, two temperate, and one extremely hot.*

WHich call you the leſſer Circles?

They are thoſe that doe not diuide the Spheare into two equall parts, as the great Circles doe, and of ſuch there bee foure, that is the two Polar Circles, and the two Tropiques, that is to ſay, the Tropique of Cancer, and the Tropique of Capricorne, of which Polar Circles the one is called Arctique, and the other Antarctique, and are made by the turning about of the two Poles of the Zodiaque, which Poles being ſituated in the Colure of the Solſtices are ſo farre diſtant from the Poles of the World, as is the greateſt declination of the Sunne from the Equinoctiall, which is 23. Degrees, 30'. as hath beene ſaid before.

Which is the Arctique Circle? and why is it ſo called?

The Arctique Circle is that which is next to the North-pole, and hath his name of this word Arctos, which is the great Beare or Charles-wayne, which are ſeuen Starres placed next to this Circle on the out-ſide thereof, and it is otherwiſe called the Septentrionall Circle of this word Septentrio, which is as much to ſay, as ſeuen Oxen, ſignified by the ſeuen Starres of the little Beare, which doe mooue ſlowly like Oxen, and are placed all within the ſaid Circle, and the bright Starre that is in the tippe of the tayle of the ſaid little Beare, is called of the Mariners the load Starre, or North Starre, whereby they ſayle on the Sea, and the Center of the Circle is the North Pole of the World, which is not to bee ſeene with mans eye.

What

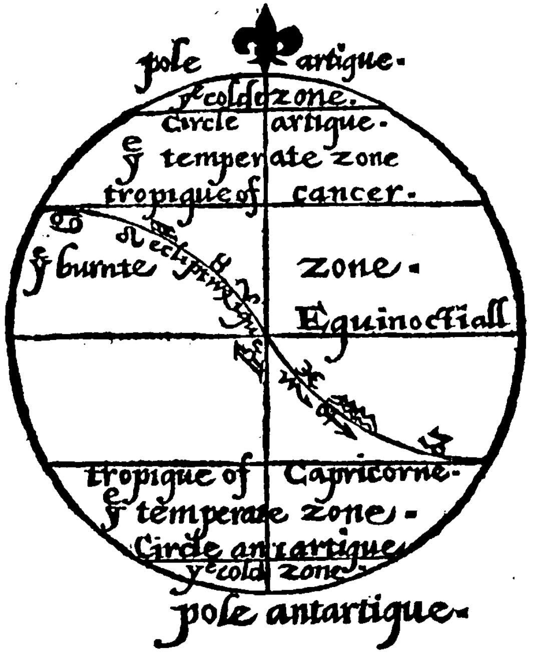
What is the Antarctique Circle?

It is that which is next vnto the South Pole, and is ſo called, becauſe it is oppoſite or contrarie to the Circle Arctique.

Now deſcribe the two Tropiques.

The tropique of Cancer is a Circle imagined to be betwixt the Equinoctiall and the Circle Arctique, which Circle the Sunne maketh when he entereth into the firſt degree of Cancer, which is about the twelfth or thirteenth day of Iune, being then in his greateſt declination from the Equinoctiall Northward, and nigheſt to our Zenith, being aſcended to the higheſt point that he can goe, at which time the dayes with vs bee at the longeſt, and the nights at the ſhorteſt. And ſo from thence he declineth to the other Tropique called the Tropique of Capricorne, which is a Circle imagined to be betwixt the Equinoctiall and the Circle Antartique, which the Sunne maketh when he entereth into the firſt degree of Capricorne, which is about the twelfth or thirteenth day of December, at which time he is againe in his greateſt declination from the Equinoctiall Southward, and furtheſt from our Zenith: whereby the dayes with vs bee then at the ſhorteſt, and the nights at the longeſt: And note that theſe two Circles are called Tropiques, of this Greeke word Tropos, which is as much to ſay, as a conuerſion or turning, for when the Sunne arriueth at any of theſe two Circlts, hee turneth backe againe either aſcending or deſcending, by reaſon of which foure Circles as well the firmament as the earth is diuided into fiue Zones, that is to ſay, two cold, two temperate, and one extremely hot, otherwiſe called the burnt Zone, of which fiue Zones, the foreſaid foure Circles are the true bounds. For of the two colde Zones, the one lyeth betwixt the North Pole and the Circle Arctique, and the other lyeth betwixt the South Pole and the Circle Antarctique, and of the two temperate Zones, the one lyeth betwixt the Circle Arctique, and the Tropique of Cancer, and the other lyeth betwixt the Circle Antartique, and the Tropiques of Capricorne, and the extreme hot Zone lyeth betwixt the two Tropiques, in the middeſt of which two Tropiques, is the Equinoctiall Line, as you may ſee in this figure, and alſo in the Spheare or Globe it ſelfe.

A figure ſhewing the fiue fore-ſaid Zones.



Of which Zones, the ancient ment were wont to ſay, that three were vnhabitable, that is, the two cold and the extreme hot, which experience ſheweth in theſe latter dayes, to bee vntrue, as wee ſhall declare more at large when wee come to treate of the diuiſion of the Earth: Againe, you haue to vnderſtand that euery one of theſe leſſer Circles doth contayne in length 360. degrees, as well as euery one of the greater Circles, but the degrees are not of like bigneſſe, no more then the Circles themſelues are like in compaſſe or circuit for the leſſer the Circles are in circuit, the leſſer their degrees muſt needes bee.

Sith euery of the leſſer Circles differ one from another in circuit, and thereby the degrees of euery Circle be leſſe then other, how ſhall I know the true quantitie of euery degree in each Circle, and how many minutes are required in euery leſſer degree proportionally to anſwer one degree of the Equinoctiall?

For the better knowledge hereof, you muſt imagine that there may be as many Circles made from the Equinoctiall towards any of the Poles, as there bee degrees of Latitude, which are in number ninetie, as hath beene ſaid before: And the nigher that any Circle is to the Equinoctiall, the greater it is in circuit, and the further from the Equinoctiall towards any of the Poles, the leſſer in circuit, and therefore more or leſſe minutes are requiſite to anſwere to one degree of the Equinoctiall, as you may eaſily perceiue by this Table following, conſiſting of ſix columnes, euery front or head whereof is noted with three great Letters, D. M. S. ſignifying degrees, minutes, and ſeconds, ſix times repeated, and in the beginning of the firſt columne on the left hand is ſet downe one degree, which is the firſt degree of ninetie, and nigheſt vnto the Equinoctiall, right againſt which one degree is placed towards the right-hand, fiftie nine minutes, and fiftie nine ſeconds: and ſo proceeding from degree to degree ſucceſsiuely, vntill you come to ninetie, you ſhall find how many minutes and ſeconds doe anſwere to one degree of the Equinoctiall. And this Table will alſo ſerue to ſhew the difference of miles in euery ſundry clime or parallel, whereof we ſhall ſpeake hereafter when we come to treate of the Earth.

A

A Table ſhewing how many minutes are requiſite to make one degree in euery leſſer circle, anſwerable to one degree of the Equinoctiall.

D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.
1	59	59	16	57	41	31	51	26	46	41	41	61	29	5	76	14	31
2	59	58	17	57	23	32	50	53	47	40	55	62	28	10	77	13	30
3	59	53	18	57	45	33	50	29	48	40	9	63	27	14	78	12	28
4	59	1	19	56	44	34	45	45	49	39	22	64	26	18	79	11	27
5	59	46	20	56	23	35	49	9	50	38	34	65	25	21	80	10	25
6	59	40	21	56	1	36	48	32	51	37	46	66	24	24	81	9	23
7	59	33	22	55	38	37	47	55	52	36	56	67	23	27	82	8	21
8	59	25	23	55	14	38	47	17	53	36	7	68	22	29	83	7	19
9	59	16	24	54	49	39	46	38	54	35	16	69	21	30	84	6	16
10	59	5	25	54	23	40	45	58	55	34	25	70	20	31	85	5	14
11	58	54	26	53	56	41	45	17	56	33	33	71	19	32	86	4	11
12	58	41	27	53	28	42	44	35	57	32	41	72	18	32	87	3	8
13	58	28	28	52	59	43	43	53	58	31	48	73	17	33	88	2	5
14	58	13	29	52	29	44	43	10	59	30	54	74	16	32	89	1	3
15	57	57	30	51	58	45	42	26	60	30	0	75	15	32	90	0	0

CHAP. XXI.

Of the ſtars and celeſtiall bodies contayned in the Firmament, and firſt of their ſubſtance.

HAuing briefly deſcribed all the Circles as well greater as leſſer that are imagined to bee in the eighth Heauen: I thinke it good now to ſpeake ſomewhat of the ſtars and celeſtiall bodies, placed in the ſaid Heauen. And firſt of their ſubſtance, and then of their mouing, figure, ſhape, number, magnitude or greatneſſe, alſo of their longitude, latitude, declination, aſcention, deſcention, both right and oblique, and of the aſcentionall difference, and finally of the thréefold Poeticall riſing and going downe of the ſtarres, but firſt of their ſubſtance.

Of what ſubſtance are the ſtarres?

The ſtarres be of the ſame ſubſtance that the Heauens are wherein they are placed, differing only from the ſame in thickneſſe, and therefore ſome defining a ſtarre doe ſay, that it is a bright and ſhining body, and the thickeſt part of his Heauen, apt both to receiue and to retayne the light of the Sunne, and thereby is viſible and obiect to the ſight; for the Heauen it ſelfe being moſt pure, thinne, tranſparent, and without colour, is not viſible, and for this cauſe the milke-white impreſſion in Heauen, like vnto a white way, called of the Aſtronomers Galaxia, and of the common people, our Ladies way, is viſible to the eye, by reaſon that it is thicker then any other part of the Heauen.

Why are not the ſtars ſeene as well in the day, as in the night?

Becauſe they are darkened by the excellent brightneſſe of the Sunne, from whom they borrow their chiefeſt light.

CHAP. XXII.

Of the mouing and ſhape of the Starres.

WHat mouing haue the Starres?

The ſelfe-ſame mouing that the Heauen hath wherein they are placed.

Whereby are the Heauens moued?

Some ſay, that the firſt moueable is turned by God himſelfe, and all the reſt of the Heauens euery one by his proper intelligence, which though it turneth his Heauen about, yet it giueth neither life, ſenſe, nor vnderſtanding thereunto, as ſome haue vntruly holden, affirming the Heauens to be liuing and intelligible bodies.

If the ſtars haue no mouing of themſelues, whereof commeth it then, that ſome ſeeme to our ſight ſometime nigher, and ſomtime further off?

All the fixed ſtarres of the Firmament are alwayes of like diſtance, not withſtanding by reaſon of the manifold mouing of the Firmament, wherein they are placed, they ſéeme to change their places, and ſometimes to bee more towards the Eaſt or Weſt, North or South. And whereas the ſeuen Planets, called the wandring ſtarres, doe change their places now héere now there, that chanceth not by their owne mouing, but by the mouing of the Heauens wherein they are placed: for a ſtarre being round of ſhape hath no members méete to walke from one place to another, but onely changeth his place through the motion of his Spheare or Heauen, wherein ſuch a Planet is fixed.

CHAP. XXIII.

Of the number of the ſtarres, and of their magnitude or greatneſſe, and into how many Images they are diuided, and how many ſtarres euery Image contayneth.

MAy the ſtarres be numbred by man?

No; for as Dauid ſaith, that belongeth onely to God, who as hée created them, ſo hée can number them, and call them all by their names, notwithſtanding the Aſtronomers by their induſtry and diligent obſeruation haue attayned to the knowledge of many: as firſt they know the ſeuen Planets, otherwiſe called the wandring ſtarres, and haue made manifeſt demonſtrations of their motions, and by continuall obſeruation haue found out the manifold vertues, powers and influences of the ſame, but of the fixed ſtarres they could neuer find more then 1022. And becauſe the ſtars are not equall in greatneſſe or bigneſſe, they make ſixe differences of greatneſſe, appointing to the firſt difference fiftéene ſtarres, which are bigger then all the reſt, whereof euery one contayneth the Earth 207. times, to the ſecond difference, fiue and fortie ſtarres, whereof euery one contayneth the

Earth nintie times. To the third they appoint 208. Starres, whereof euery one containeth the earth 72. times. To the fourth difference they appoint 474. ſtars, whereof euery one contayneth the Earth 54. times. To the fift they aſſigne 217. ſtarres, whereof euery one contayneth the Earth 57. times. To the ſixt or laſt greatnes they appoint 49. ſmall ſtars, wherof euery one contayneth the Earth eighteene times, and ſome ſay twentie times. Beſides theſe, there be fourteene others, whereof fiue bee called cloudie and the other darke, becauſe they are not to bee ſeene but of a very quick and ſharpe ſight. And you haue to note that the ancient Aſtronomers do diuide all the fixed ſtars to them knowne into 48. Images, whereof they liken ſome to liuing things, as to men, women, beaſts mōſters, fowles, fiſhes and creeping wormes, and to ſome things without life, hauing ſome artificiall ſhape, of which 48. Images, they appoint 12. to the Zodiaque, commonly called the twelue Signes, as Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius and Piſces. Againe, they place in the North part of the Firmament 21. Images, and in the South part thereof fifteene Images, which make in all 48. The deſcription of all which Images, together with their names hereafter followeth: and firſt I will deſcribe vnto you the twelue Images contayned in the Zodiaque.

CHAP. XXIIII.

Of the twelue Images or Signes of the Zodiaque.

The twelue ſignes (as ſome affirme) do contayne of the foreſaid number of fixed ſtarres 273. for the firſt ſigne called Aries, that is to ſay, the Ramme, contayneth 13. ſtarres, which Image or ſigne being placed in the coniunction of the Zodiaque with the Equinoctiall, hath his backe turned towards the North, and his head towards the Eaſt, and riſeth with his head, and goeth downe with his feet.

The

The ſecond ſigne called Taurus, that is to ſay, the Bull, contayneth 33. ſtars, whereof there is one bright ſtar of the firſt bignes called Oculus Tauri, that is to ſay, the Buls eye, who hath his head enclined towards the Weſt, as though hee looked towards the Earth, and riſeth and goeth downe with his heeles vpward. The third Signe called Gemini, that is to ſay, the twins, do containe eighteene ſtars, their heads looking towards the North, and their backes being ioyned together doe imbrace one another, doe riſe lying, and doe go downe with their feet. The fourth Signe called Cancer, that is to ſay, the Crab, contayneth nine Starres, extending his feete towards both the Poles, & looking towards Leo, hath his belly turned towards the earth, and he riſeth and falleth with his hinder part or backpart of his body. The fifth Signe called Leo, that is to ſay, the Lion containeth ten ſtarres, whereof there be two bright ſtars of the firſt bigneſſe, the one in his breſt called Cor Leonis, and Regulus, that is to ſay, the Lions heart, and the other in his tayle called Cauda Leonis, that is to ſay, the Lions tayle, who looketh towards Cancer, and hauing his backe turned towards the North, he riſeth and goeth downe with his head. The ſixth Signe called Virgo, that is to ſay, the Virgin, whoſe head is behind the Lion, and toucheth the Equinoctiall Line with her left hand, holding in the ſame hand an eare of corne, ſhe both riſeth and goeth downe with her head: this Image containeth ſix and twentie ſtars, whereof there is one bright ſtarre of the firſt bigneſſe, called Spica Virginis, that is to ſay, an eare of Corne. The ſeuenth Signe called Libra, that is to ſay, the Ballance, contayning eight ſtars, hath two ſkales, whereof the one hangeth towards the North, and the other towards the South. The eighth Signe called Scorpio, that is to ſay, the Scorpion, contayneth one and twenty ſtars, who looketh towards Virgo, and extendeth his feet towards both the Poles, he boweth his tayle towards the North, hauing his belly turned towards the Earth, and he riſeth and goeth downe bowing: The ninth Signe call Sagittarius, that is to ſay, the Archer, contayning one and thirtie ſtarres, hath his head towards the North, and looketh towards the Scorpion, hauing a bow & a ſhaft, whereof

the

the bow toucheth his left hand, and his left foot, hee riſeth right vp and goeth downe headlong. The tenth Signe called Capricornus, that is to ſay, the Goat, contayning eight and twentie ſtarres, hath his backe turned towards the North, and his head towards the Archer, and turning himſelfe towards Aquarius, he riſeth right vp, and goeth downe head-long. The eleuenth Signe called Aquarius, that is to ſay, the Water-bearer, contayning two and forty ſtarres, hath his head towards the North, extending his left hand vpon the backe of Capricorne, and with his right hand powreth water out of his pot, which bendeth towards the Eaſt, runneth euen to Piſces, hee riſeth and goeth downe with his head before any other of his members. The twelfth Signe called Piſces, that is to ſay, two Fiſhes, doe contayne foure and thirtie ſtarres, whereof the backe of the firſt is towards the North, and the backe of the ſecond towards the Weſt arme of Andromeda, and one of the Fiſhes looketh towards Aquarius, and the other towards the North, and betwixt theſe two Fiſhes is a certaine little Line, wherewith their tayles are bound together, as it were with a bond, the lower part of which Fiſhes doth alwayes both riſe and goe downe, and not the vpper part. And though the twelue Signes of the Zodiaque are ſaid to bee equall both in length and breadth, that is to ſay, hauing thirtie degrees in length, and twelue degrees in breadth, as hath beene ſaid before, yet theſe Images are not equall, for ſome doe extend further then the Zodiaque in breadth, and ſome are more then thirtie degrees in length. As the Tables of Alphonſus doe manifeſtly ſhew, who ſaith there, that the twelue Signes do containe three hundred and fiftie ſtarres, for he appointeth to Aries eighteene, to Taurus fortie foure, to Gemini twentie fiue, to Cancer thirteene, to Leo thirtie fiue, to Virgo thirtie two, to Libra ſeuenteene, to Scorpio twentie foure, to Sagittarius thirtie and one, to Capricornus twentie eight, to Aquarius forty fiue, to Piſces thirtie eight, which make in all three hundred and fifty: in which Tables are alſo ſet downe the longitude, latitude, and magnitude of the ſaid ſtars, but the longitude of the ſaid Starres is farre altered from that longitude which they had in his time, whereof we ſhall ſpeake hereafter more at large.

CHAP. XXV.

Of the one and twentie Northerne Images.

Which be they?

These heere following; firſt, Vrſa minor, that is to ſay, the leſſer Beare, contayning ſeuen ſtars, the tayle-ſtarre whereof being a bright ſtar of the third bignes, is called the load-ſtarre: The ſecond is called Vrſa maior, that is to ſay, the great Beare, contayning ſeuen and twentie ſtarres, whereof there bee ſeuen principall, making a ſhape like vnto a Cart with foure wheeles, and therefore it is commonly called Charles wayne. The third is calld Draco, that is to ſay, the Dragon that kept Iuno's Orchard from robbing, containing one and thirty ſtars. The fourth is called Cepheus, the proper name of a King of Ethiope, contayning eleuen ſtars. The fift is called Bootes, that is to ſay, the roring keeper of the Beare, contayning 22. ſtars, wherof there is one bright ſtar betwixt his legs, of the firſt bignes, called Arcturus. The ſixt is called Corona Ariadnæ, that is to ſay, the Crowne of Ariadna the daughter of king Minos, contayning eight ſtars. The ſeuenth is Hercules, who lyeth groueling with his heeles towards the North pole, holding a Club in his right hand, and a Lions ſkin hanging on his left arme, contayning 28. ſtars. The eight is called Lyra, that is to ſay, an inſtrument of Muſick like a Harpe, placed in Heauen in the memory of Orpheus, contayning ten ſtarres. The ninth is called Cignus, that is to ſay, the Swanne, into which Iupiter transformes himſelfe to deceiue the Nymph Læda, contayning ſeuenteene ſtars. The tenth is called Caſſiopeia ſitting in her chaire, wife to Cepheus, and Mother to Andromeda, contayning thirteene ſtars. The eleuenth is called Perſeus, holding his ſword in the one hand, and the head of Gorgon or Meduſa in the other hand, whoſe haires were all Serpents, contayng twentie ſixe ſtarres.

ſtarres. The twelfth is Auriga and Erictonius, who was the inuenter of the firſt Chariot that euer was made, contayning thirteene ſtarres. The thirteenth is called Serpentarius and Anguitenens, that is to ſay, he that holdeth the Serpent, who (as ſome thinke) was Æſculapius the famous Phyſitian, contayning foure and twentie ſtarres. The fourteenth is called Serpens, or Anguis, that is to ſay, the Serpent of Æſculapius contayning eighteene ſtarres. The fifteenth is called Sagitta or Telum, that is to ſay, the ſhaft or dart wherewith Hercules ſlew the Eagle tormenting Prometheus in the mount Caucaſus, contayning fiue ſtarres. The ſixteenth is called Aquila, that is to ſay, the Eagle which carryed Ganimedes into Heauen, contayning nine ſtarres. The ſeuenteenth is called Delphinus, that is to ſay, the Dolphin, which ſaued Arion that excellent Muſitian, being caſt by Pirats into the Sea, contayning ten ſtarres. The eighteenth is called Minor Equus, that is to ſay, the leſſer horſe, containing only foure little darke ſtars in his head. The nineteenth is the great Horſe called Pægaſus, that is to ſay, the winged Horſe, wherewith Bellerophon conquered the monſtrous beaſt called Chimera, which was halfe a Lion and halfe a Dragon, and is adorned with twentie ſtars. The twentieth is called Andromeda, the Daughter of Cepheus, by Caſſiopeia, and Wife to Perſeus, who for her conſtant loue towards her Huſband, was placed in Heauen nigh vnto him, and was adorned with three and twenty ſtars. The one and twentieth is called Triangulum, that is to ſay, a Triangle or three cornered figure, which being like in ſhape to the Ile Sicilia, the Goddeſſe Ceres obtained to be placed in Heauen, and was adorned with foure ſtarres, that is to ſay, euery corner one, and the fourth in the middeſt of the ſhorteſt ſide: To theſe (in myne opinion) ought to be added Bernices haire, called crinis Bernices, which in all Celeſtiall Globes is placed not farre from the right hinder foot of the great Beare, and this Image contayneth foure little ſtarres.

CHAP.

CHAP. XXVI.

Of the fifteene Southerne Images.

Which be they?

These hereafter following, whereof the firſt is called Cætus, that is to ſay, the Whale, that monſtrous fiſh, which by the appointment of Neptune would haue deſtroyed Andromeda, whom Perſeus deliuered by killing the Fiſh, & afterwards took Andromeda to wife, which Fiſh Neptune placed in Heauen, adorning the ſame with two and twentie Starres. The ſecond is called Orion, with his ſword by his ſide, who afterward was ſlaine by Diana, by miſhap againſt her will, for the which ſhee placed him in Heauen, adorning him with eight and thirtie Starres, whereof there be two bright Starres of the firſt bigneſſe, the one in his right ſhoulder, called Bed Alguze, and the other in his left foot called Rigell Alguze. The third, is the floud called Eridanus, into the which Phaeton the ſon of Apollo was ſtriken with a thunderbolt by Iupiter for burning the earth, by raſhly driuing his Fathers Chariot, which he was not able to guide, in memorie whereof the floud was placed in Heauen, and adorned with 34. ſtarres, whereof one is a bright ſtarre of the firſt bigneſſe called Acarnar. The fourth is called Lepus, that is to ſay, the Hare, placed nigh vnto Orion, becauſe he was a Hunter, adorned with twelue ſtars. The fift is called Canis maior, that is to ſay, the great Dog, paſſing all other in ſwiftnes, which was giuen by Aurora to Cepheus the Son of Æolus, and is placed next to the Hare, being adorned with eighteene ſtarres, whereof there is in his mouth a very faire ſtarre of the firſt bigneſſe called Syrius. The ſixth is called Canis minor, that is to ſay; the leſſer Dogge, without the which Orion his Maſter would not bee placed in Heauen, which hath but two ſtarres, whereof the one is in his flancke, and is a bright ſtarre of the firſt bignes called Canicula and Porcion. The ſeuenth is the ſhip called Argos, in the which Iaſon and his companions

ſailed:

ſailed to Colcos, to winne the golden Fleece, which is adorned with 45. ſtars, whereof there is one bright ſtarre of the firſt bigneſſe in the left Oare called Canopus. The eight is called Hydra, that is to ſay, the Water-ſerpent which Hercules ſlew, or as ſome ſay, which kept the water bowle, and would not ſuffer the thirſtie Crow to drinke, which Crow Apollo ſent for water to doe ſacrifice, and is adorned with 25. ſtars. The ninth is called Crater, that is to ſay, the Cup or Bowle which the Crow brought too late vnto Apollo, and therefore his feathers were made all blacke, whereas before they were white, contayning ſeuen ſtars. The tenth is called Coruus, that is to ſay, the Crow before mentioned, adorned with ſeuen ſtars. The eleuenth is called Chiron ſiue Centaurus, the Sonne of Saturne, paſſing all others in iuſtice and religion, and therefore is figured in heauen as though he were offering ſacrifice vpon an Altar, adorned with 37. ſtars, whereof there is one bright ſtarre of the firſt bignes in his right foot, called Chiron & Centaurus. The twelfth is called Lupus, that is to ſay, the Wolfe, into which Licaon the cruell Tyrant was turned by Iupiter, or as ſome ſay, that Wolfe which Centaurus killed to do ſacrifice vpon the altar, contayning nineteene ſtars. The thirteenth is called Ara, that is to ſay, the Altar made by the Smithes of Vulcan, whereupon all the Gods ſware to reuenge the inſolencie and pride of the Giants, which altar is placed next to Centaurus, being adorned with ſeuen ſtars. The fourteenth is called Corona Auſtralis, that is to ſay, the Southerne Crowne which Bacchus did weare when hee fetched his Mother Semele from Hell, which is placed in Heauen, and is adorned with thirteene ſtars. The fifteenth and laſt of the Southerne Signes is called Piſces Auſtralis, that is to ſay, the Southerne Fiſh which was placed in heauen, in the memoriall of the fiſhes which the people of Syria did worſhip as their gods, and is adorned with twelue ſtars, whereof there is one bright ſtar of the firſt bigneſſe in his mouth called Fomahant: All which Images and Signes before mentioned, as well Northerne as Southerne, you may ſee plainly deſcribed in euery celeſtiall Globe, and alſo ſet forth in Plano in the nether end of Vopellius his vniuerſall Map, that is to ſay; the Northerne ſignes on the left ſide, and the Southerne ſignes on the right ſide of the Map: Or in the front of Planctius his great vniuerſall Map, who in the rondle repreſenting the Southerne halfe of the celeſtiall Globe, ſetteth downe alſo certaine Southerne ſtarres lately found out by the trauellers into the Indies, as the Croſſe, the Southerne Triangle, Noah his Doue or Pigion, and another in ſhape of a Man called Polophilax, ſo as there be now in all 19. Southerne Images.

CHAP. XXVII.

Of the longitude of the fixed ſtarres, and of the preceſſion of the vernall Equinoctiall point, and what it is.

WHat is the Longitude of a ſtarre?

The Longitude of any ſtarre, is that Arke or portion of the Ecliptique Line, which is contayned betwixt the firſt point of Aries, and the Circle which paſſeth through the Poles of the Zodiaque, and alſo through the bodie of the ſtar, as for example, the ſtar called Cor Leonis, is diſtant in theſe dayes from the vernall Equinoctiall point of the Ecliptique line, 143. degrees, and 3'2. and thereby is found to be in 23. degree, and 3'2. of Leo, againe, the ſtar called Spica Virginis, in theſe dayes is diſtant from the firſt point of Aries, 198. degrees, and ſo is found to be in the eighteenth of Libra.

Why doe you ſay in theſe dayes?

Becauſe the fixed ſtarres in proceſſe of time, do change their Longitude by reaſon of their proper mouing vpon the Poles of the Zodiaque, which is from Weſt to Eaſt, for whereas Spica Virginis in Ptolomies time was in the 26. degree of Virgo, it is found now to be in the eighteenth of Libra, the cauſe whereof is the preceſſion of the Equinoctiall point or ſection.

Define what that Preceſſion is.

It is an Arke or portion of the Ecliptick line, contayned betwixt

twixt two great Circles, both paſſing through the Poles of the Zodiaque, in ſuch ſort as the one paſſeth through the firſt minute of the vernall Equinoctiall point of the ſaid Ecliptique, and the other Circle paſſeth through the firſt or former ſtar of the Rams horne, from which ſtarre the Aſtronomers do make all the celeſtiall motions and reuolutions to take their firſt beginning, and this ſtarre in old times paſt was known to be before the vernall Equinoctiall point, which is the firſt moment of Aries, but now it is found to haue paſſed that point ſo farre towards the Solſticiall point, as in theſe dayes it is knowne to be in the 27. degrée, and 4′2. of Aries, and in proceſſe of time it will be cleane out of Aries, and enter into Taurus.

CHAP. XXVIII.

Of the Latitude of the fixed Starres.

WHat is the Latitude of a Starre?

The Latitude is none other thing, but the diſtance of any ſtar from the Ecliptick Line, either towards the North or South Pole of the Zodiaque, and ſuch Latitude neuer changeth or altereth, for as the ſtarre Spica Virginis, is at this preſent two degrées diſtant from the Ecliptick Line towards the South, ſo it euer hath béene and euer ſhall be, and the like is to be ſaid of all the reſt of the fixed ſtarres, which do alwayes kéepe their Latitude, be it Northward or Southward, néere to the Ecliptique, or farre from the ſame.

CHAP. XXIX.

Of the declination of the fixed Starres.

WHat is a declination of a Starre?

The declination is none other thing, but the diſtance of any fixed Starre from the Equinoctiall, eyther Northward or Southward, which is mutable as well as the Longitude: for as the fixed ſtars do change their Longitudes, ſo alſo by little and little, they decline either more or leſſe from the Equinoctiall: As for example, the declination of the ſtar called Canicula, that is to ſay, the leſſer Dogge in the yeare of our Lord 138. when Ptolomie liued, was fiftéene degrées, 4′4. and 38″. towards the South. But in theſe dayes the declination of the ſaid ſtarre is but ſixe degrées and 7′. towards the South, and by reaſon that the fixed ſtars in proceſſe of time doe change their Longitude and declination, they are not alwayes vnder one ſelfe ſigne, but doe flit out of one ſigne into another.

How is the Longitude, Latitude, and declination of any ſtar to be knowne? and how are the ſtars themſelues to be knowne in the Firmament?

The Longitude, Latitude, and declination of any ſtar, is to be knowne moſt truly by the Aſtronomicall Tables calculated of purpoſe, and you may know the ſame alſo without hauing regard to euery ſmall minute, by helpe of the celeſtiall Globe, all the neceſſarie vſes whereof, I haue ſet downe in a little Treatiſe to be added hereafter to this Booke, and there alſo I ſhew you how to find out any ſtar in the firmament that is deſcribed in the Globe, in which Globe are ſet downe as many ſtarres as euer were knowne, a few excepted towards the South Pole, which were found out but of late dayes, of which ſtarres I ſhall haue occaſion to ſpeake hereafter in my Treatiſe of Nauigation. In the meane time, I will procéed to the aſcention and deſcention of the ſtarres, both right, meane, and oblique.

CHAP. XXX.

Of the aſcention and deſcention, that is, the riſing and ſetting of the Starres, as well according to the Aſtronomers, as according to the Poets.

DOe the Aſtronomers and Poets differ touching this matter?

Yea, they differ greatly, as well in name as in matter: for whereas of the Poets it is called ortus & occaſus Signorum, that is to ſay, the riſing and falling of the Signes, ſo of the Aſtronomers it is called Aſcentio & Deſcentio Signorum, that is to ſay, the aſcention and deſcention of the Signes: againe, they differ in matter, or rather in manner, for that the Aſtronomers doe conſider the riſing and falling of the ſtarres more exactly then the Poets: for the Aſtronomers doe conſider the degrees and minutes of the ſame, and alſo doe ground their aſcention and deſcention, vpon more certaine demonſtrations then the Poets. Moreouer, whereas the Poets by their manner of riſing and falling, doe ſimply ſet downe the time of things done, or to be done, the Aſtronomers do the ſame a great deale more exactly, and by their manner of aſcention and deſcention doe conſider the encreaſe and decreaſe of the dayes: of the which Aſtronomicall aſcention and deſcention, I mind heere to treate, firſt in generall, and then in particular.

CHAP. XXXI.

Of the Aſtronomicall aſcention and deſcention in generall, both right, meane, and oblique, and what a giuen Arke is.

DEfine what the Aſtronomicall aſcention and deſcention is.

Aſtronomicall aſcention is that portion or Arke of the Equinoctiall Line, which riſeth together with ſome giuen Arke of the Ecliptique Line aboue the Horizon, and the deſcention, is that portion or Arke of the Equinoctiall, that goeth downe or ſetteth together, with ſome giuen Arke of the Ecliptique Line vnder the Horizon, according to the mouing of the World, which is from Eaſt to Weſt.

What meane you by giuen Arke?

A giuen Arke is as much to ſay, as ſome ſuppoſed portion of the Ecliptique or of any other circle, as if you would know the aſcention of ſome ſuppoſed portion of the Ecliptique, contayning for example 25. or 30. degrees, heere this portion of the Ecliptick contayning that number of degrees, is called the giuen Arke, of which Arkes ſome are called continuall, and ſome diſcrete or diuided, which I mind to Engliſh heere whole and broken, for ſo I do Engliſh quantitas cōtinua, & diſcreta, in my Logick. That Arke is ſaid to be continuall or whole which taketh his beginning from the firſt point of Aries, and ſo proceeding orderly, endeth at ſome other degree of the ſaid Ecliptique. And that Arke is called diſcrete or broken, which doth not take his beginning from the firſt point of Aries, but beginneth at ſome other degree of the Ecliptique, as for example; ſuppoſe that it beginneth at the fourteenth of Taurus, and endeth at the fifteenth of Gemini, this Arke is called a diuided or broken Arke, becauſe it doth not begin at the firſt point of Aries, and ſo proceed ſucceſſiuely. Moreouer you haue to vnderſtand that the ancient Aſtronomers, doe commonly make but two kinds of aſcention and deſcention, that is, right and oblique, but there be indéed thrée kinds of aſcention, that is to ſay, right, oblique, and meane aſcention.

When is any aſcention ſaid to be right, oblique or meane?

It is ſaid to bee right, when portion of the Equinoctiall which riſeth or goeth downe together with the Ecliptique, is greater or more in circuit then that of the Ecliptique. And it is ſaid to be oblique; when that portion of the Equinoctiall which riſeth or falleth together with the Ecliptique, is leſſer then that of the Ecliptique: Againe, that is ſaid to bee meane aſcention, when that portion of the Ecliptique, which aſcendeth, is neyther greater nor leſſer then that of the Equinoctiall: for as in the right Spheare euery quarter of the Ecliptique hath a meane aſcention, and equall to euery quarter of the Equinoctiall, beginning the quarters at any of the foure principall points, ſo if you take thrée ſignes in any other part of the Zodiaque, their aſcentions will not agrée with a quarter of the Equinoctiall, ſith there is no one ſigne that doth equally agree with the like portion of the Equinoctiall: and all this matter dependeth vpon the knowledge of the vſe of certaine Circles before defined.

Which be they?

Theſe thrée, the Zodiaque, the Equinoctiall, and the Horizon: for firſt, the Zodiaque doth ſhew the place of the Sun, that is to ſay, in what degrée it is of any ſigne, together with the minutes of the ſame, and turning about euery day by the diurnall motion, doth both appeare aboue the Horizon, and alſo is hidden vnder the Horizon. Secondly, the Equinoctiall with his equall riſing and going downe, doth meaſure the time of the Sunne whileſt he maketh his abode vnequally and diuerſly aboue the Horizon. Thirdly, the Horiſon diuideth the one Hemiſpheare from the other, on which Horizon is to bee conſidered what Angle any ſigne or ſtar maketh therewith, in his aſcention or deſcention: and according as any portion of the Ecliptique riſeth or ſetteth rightly or obliquely, ſo in reſpect of the Angle, which it maketh with the Horizon, it is called a right or oblique aſcention or deſcention.

Why ſhould the aſcentions and deſcentions bee meaſured rather by the Equinoctiall line then by the Ecliptique, ſith the courſe of the Sunne meaſureth all times?

The cauſe thereof is the obliquity of the Zodiaque, hauing diuers and variable ſituations, whereby the Sunne abideth ſometimes a great while aboue the Horizon, and ſometimes but a little while, all which inequalitie is only to be meaſured by the Equinoctiall, which is alwayes equally moued vpon his Poles. Hitherto of the Aſtronomicall aſcention and deſcention in generall: Now of all thrée aſcentions and deſcentions in particular.

CHAP. XXXII.

Of the right, oblique and meane aſcention in particular, and of the chiefeſt cauſes of ſuch diuerſitie of aſcention.

AND for the better vnderſtanding of the Aſtronomicall aſcention and deſcention, we will make this diuiſion: for either it is of ſome point or Star, or elſe of ſome portion of a Circle, chiefly of the Ecliptique Line. In the aſcention of any point or Starre, wee conſider two things, firſt what angle it maketh with the Horizon either right or oblique. Secondly, the time from the riſing of the firſt minute of Aries, which is the firſt beginning of the longitude of any ſtar or Circle in heauen: and in reſpect of the Angle euery aſcention is ſaid to be right in a right Spheare, and oblique in an oblique Spheare. Againe, the time of yͤ aſcention is to be meaſured by the degrées of the Equinoctiall from the firſt minute of Aries, vnto that degrée and minute of the Equinoctiall, which aſcendeth together with the ſtars. And note by the way that 15. degrées of the Equinoctiall do make an houre, and foure do make one degrée of the Equinoctiall: for foure times 15. do make 60. minutes, which is an houre. Againe, euery aſcention conſidered according to the time of his gate, is either right, oblique, or meane: if it be right, it is ſlow: if it be oblique, it is quicke: if it be meane, it is equal. Now the aſcention or any Arke or portion of a circle is alſo either right, oblique, or meane: if it be right, it aſcendeth ſlowly: if oblique, it aſcendeth quickly: if meane, it aſcendeth equally. And the better to vnderſtand all theſe thrée kinds of aſcentions, I will ſet downe theſe twelue rules heere following, whereof fiue do belong to the right Spheare, and ſeuen to the oblique.

1 In the right Spheare all the foure quarters riſing from the foure principall points, haue a meane aſcention, and ſo hath all the foure points themſelues.

2 In the right Spheare all thoſe ſignes that bee equally diſtant from the foure principall points, haue equall aſcentions.

3 In the right Spheare all ſtarres or points that be in the Solſticiall Colure haue meane aſcention.

4 In the right Spheare thoſe ſignes that doe aſcend rightly, doe deſcend rightly, and thoſe that doe aſcend obliquely, doe deſcend obliquely.

5 In the right Spheare, Gemini, Cancer, Sagittarius, and Capricornus, doe aſcend rightly, and all the reſt obliquely.

6 In the oblique Spheare, the two Equinoctiall points haue meane aſcention.

7 In the oblique Spheare each halfe of the Spheare, beginning at either of the Equinoxes haue meane aſcention: but this rule holdeth not, if that you begin any other where.

8 In the oblique Spheare, thoſe ſignes that do aſcend rightly doe deſcend obliquely, and thoſe which aſcend obliquely doe deſcend rightly.

9 In the oblique Spheare, the aſcention of any ſuppoſed ſigne is equall to the deſcention of his oppoſite ſigne, and the deſcention of any ſuppoſed ſigne is equall to the aſcention of his oppoſite ſigne.

10 In the oblique Spheare, the aſcention of any ſigne being added to his deſcention, is equall to the aſcention and deſcention of the ſame ſigne being in the right Spheare.

11 In the oblique Spheare, euery two ſignes equally diſtant from the two points of the Equinoctiall, haue equall aſcentions and deſcentions.

12 In the obliquely Spheare vnder the Pole Arctique, all ſignes from Cancer to Capricorne, do aſcend rightly, and all the reſt obliquely, but contrariwiſe vnder the Pole Antarctique.

What is the chiefe cauſe of the diuerſitie of aſcention and deſcentions, as well in the right as in the oblique Spheare?

The chiefe cauſe is the diuerſitie of the Angles, which the Zodiaque maketh with the Horizon: for the ſharper that the Angles be, the leſſer portion of the Equinoctial riſeth together with the Ecliptique, and the righter that the Angles bee, the greater portion of the Equinoctiall riſeth; but the Equinoctiall by reaſon of his vniformitie, maketh his Angles alwayes equall one to another, that is to ſay, in the right Spheare, it maketh right Angles, and in the oblique Spheare, though not right, yet in euery Signe it maketh like Angles.

CHAP. XXXIII.

How to know the diuerſities of the aſcentions and deſcentions, as well in the right as oblique Spheare.

THat is to bee knowne moſt exactly by the Tables of aſcentions calculated of purpoſe by Iohannes de Monte Regio, & by Reinholdus called in Latine Tabulæ directionum, and you may know it alſo without hauing reſpect to euery minute by marking and obſeruing the ſame in a materiall Spheare or Globe, that hath a ſtanding foot with a firme Horizon: for if you will know the diuerſities of aſcentions in a right Spheare, then you muſt lay the Spheare or Globe ſo as the Horizon may paſſe through both the Poles, & in turning about with your hand the Equinoctiall, together with the Ecliptique from Eaſt to Weſt, marke with what degrée of the Equinoctiall any Signe beginneth to aſcend; and marke that degrée of the Equinoctial with a little peece of wax: then turne the Globe or Spheare towards the Weſt, vntill the laſt degrée of the ſaid ſigne doe appeare iuſt with the vpper edge of the Horizon, and then marke what degrée of the Equinoctiall

noctiall is anſwerable to the ſaid laſt degree of the fore-ſaid ſigne, and there ſet another piece of wax: then count the degrees of the Equinoctial contayned betwixt thoſe two markes: & if it be more then 30. that ſigne is ſaid to aſcend rightly, if it be leſſe then 30. then that ſigne aſcendeth obliquely, if it be iuſt 30. then it hath a meane aſcention; and by allowing 15. degrees of the Equinoctiall to an houre, and 4′. to a degree, you ſhall know in what time that ſigne riſeth. As for example, if you would know what aſcention the whole ſigne Taurus hath in a right ſpheare, and alſo in what time it riſeth, do thus: Firſt, lay both the poles of the Spheare iuſt vpon the Horizon, ſo as the ſame Horizon may paſſe through both the Poles, then bring the firſt point of Taurus to the Eaſt part of the Horizon, ſo as it may touch the vpper brimme or edge of the Horizon, and ſtaying it there with your hand, looke what degree of the Equinoctial doth alſo touch the Horizon at that inſtant, which you ſhall finde to be 27. degrees 5′4. and marke that degree of the Equinoctiall with a little piece of waxe, or ſome other thing that may bee eaſily put out or taken away: that done, put forward the foreſaid ſigne Taurus ſtill towards the Weſt, vntill the laſt degree of the ſaid ſigne bee aſcended vp euen to the vpper edge of the Horizon, and there ſtaying it with your hand, looke againe what degree of the Equinoctiall doth riſe with all, which you ſhall find to be 57. degrees 4′8. and there ſet another marke vpon the Equinoctiall: then by telling the degrees contayned in the Equinoctiall betwixt the two markes, you ſhall find the number of degrees to be 29. degrees 5′4. and by allowing fifteene degrees to one houre, and 4′. to a degree, you ſhall finde that the whole ſigne Taurus ſpendeth in his riſing one houre, 5′9. 3″6. But now ſith the Meridian in any place (as hath beene ſaid before) doth alwayes ſhew the right aſcention of any Starre, Signe, Arke, or point, becauſe that cutteth both the Equinoctiall and the Horizon with right Angles: you may therefore finde the right aſcention of the ſaid ſigne, or of any other ſigne or ſtarre, without remouing the Spheare from your owne eleuation, or Latitude in this manner following. Bring the firſt degree of Taurus cloſe to the mooueable Meridian, and there ſtaying it,

marke

marke what degree of the Equinoctiall the Meridian cutteth at that preſent, which you ſhall finde to bee 27. degrees, 5′4. which is the right aſcention of the firſt point of Taurus: then hauing brought the laſt point of Taurus to the foreſaid Meridian, marke what degree of the Equinoctiall the ſaid Meridian cutteth at that preſent, and you ſhall finde it to bee the 57. degrees, 4′8. now by counting vpon the Equinoctiall the degrees contayned betwixt thoſe two markes, you ſhall find the number to bee 29. degrees 5′4. and you may finde the ſelfe-ſame number by ſubtracting the right aſcention of the firſt point of Taurus, out of the right aſcention of the laſt point of Taurus, and thereby you ſhall know the time of his riſing to bee the ſame that you found in the right Spheare. Now if you would know the aſcention of any Signe in an oblique Spheare, then hauing placed your Spheare according to your Latitude, which for example ſake ſuppoſe to be two and fiftie degrees, and that in ſuch Latitude you would know what aſcention the whole Signe Taurus hath, and in what time he riſeth, you muſt firſt bring the firſt degree of Taurus to the Eaſt part of the Horizon, ſo as it may meete euen with the vpper edge of the Horizon: and there ſtaying it, marke what degree of the Equinoctiall riſeth therewith, which you ſhall find to be twelue degrees, 4′8. and hauing marked that degree, put forward the foreſaid Signe Taurus towards the Weſt, vntill the laſt degree thereof be aſcended vp to the vpper edge of the Horizon, and then make another marke vpon the point of the Equinoctiall, which riſeth at that inſtant with the laſt degree of Taurus, which you ſhall find to be 29. degrees, 4′2. and by counting the degrees contayned in the Equinoctiall betwixt the two markes, or by taking the leſſer aſcention out of the greater, you ſhall find the number of degrees to bee 16. and 5′4. whereby you may conclude that the aſcention of Taurus in that Latitude is oblique, and that he ſpendeth in his riſing one whole houre 7′. 3″6. And looke what order is heere taught to find out the aſcention of any Signe, the ſame order is to bee obſerued for the finding out of the deſcention of any ſigne, ſauing that you muſt ſeeke for the deſcention of any ſigne, in the Weſt part of the Horizon of the

Spheare

Spheare or Globe, and not in the Eaſt part. As for example, if you would know what deſcention Taurus hath, and in what time hee deſcendeth in the fore-ſaid Latitude: héere hauing brought the firſt degrée of Taurus to the Weſt part of the Horizon, ſo as it may touch the vpper edge thereof, and hauing alſo marked what point or degree of the Equinoctiall toucheth the ſame Horizon at that inſtant, which you ſhall finde to bee two and fortie degrees, 3′0. ceaſe not to turne the Spheare or Globe, vntill all the whole Signe of Taurus be deſcended vnder the Horizon, and that the laſt degree thereof doe meete iuſt with the vpper edge of the Horizon, and there ſtay it vntill you haue againe marked that point of the Equinoctiall, which toucheth the Horizon at that inſtant, which you ſhall find to be eightie foure degrees, 5′4. and by counting the degrees contayned betwixt the two markes on the Equinoctiall, you ſhall find the number of degrees to be two and fortie degrees, 2′4. ſo as you may conclude, that the deſcention of Taurus in that Latitude is right, and that hee ſpendeth in his going downe two houres 48′.

How ſhall I know the right or oblique aſcention of any of the fixed ſtarres, and alſo at what houre of the day or night they riſe and ſet, and how long they abide aboue the Horizon? finally when they are at the higheſt, and when they are at the loweſt, called the depreſſion or loweſt Meridian Altitude of the Starres?

All theſe things are moſt truly knowne by Tables, calculated of purpoſe, and alſo they are to be knowne by helpe of the celeſtiall Globe, in ſuch manner as ſhall be declared hereafter, when we come to treate of the ſaid Globe.

CHAP. XXXIIII.

Of the aſcentionall difference and vſes thereof.

WHat is the aſcentionall difference?

It is a portion of the Equinoctiall, whereby is knowne how much the right aſcention and oblique aſcention of any ſtarre, or portion of the Ecliptique Line, or any other point in the Firmament, doth differ one from another. As for example, in that place where the Pole is eleuated two and fiftie degrées, and the declination eleuen degrées, 32′. the right aſcention of the firſt point of Taurus, is ſeuen and twenty degrées, and 5′4. and the oblique aſcention of the ſame point is twelue degrées, 4′8. héere by taking the leſſer out of the greater, that is, twelue degrées, 4′8. out of ſeuen and twenty degrées, and 5′4. there will remayne fiftéene degrées and 6′. which is the aſcentionall difference.

What vſes hath the aſcentionall difference?

The aſcentionall difference being knowne, all the oblique aſcentions and deſcentions of the ſtarres are eaſily knowne by the Tables of Directions: againe, by this difference is knowne the encreaſe and decreaſe of the artificiall day in euery Latitude: and therefore it is called of ſome incrementum diei. Moreouer, it ſheweth the ſemidiurnall Arke of the artificiall day, for in euery oblique Spheare, the artificial day is alwaies either longer or ſhorter, then the Equinoctiall day throughout the yeare, vnleſſe the Sunne bee in either of the Equinoctiall points.

How is the encreaſe or decreaſe of the day, to be knowne by the aſcentionall difference?

That ſhall bee declared héereafter in the fiftieth Chapter of this firſt Booke, whereas we treate of the artificiall day and night. In the meane time wee will ſpeake ſomewhat of the Poeticall riſing and ſetting of the Starres.

CHAP. XXXV.

Of the Poeticall riſing and ſetting of the Starres.

DEfine what the Poeticall riſing and ſetting is.

The Poeticall riſing is the appearing of ſome ſtarre aboue the Horizon, determined by the Sunne: and the Poeticall ſetting, is either the going downe of ſome ſtar vnder the Horizon, or elſe the hiding thereof vnder the beames of the Sunne.

How manifold is the Poeticall riſing and ſetting?

Thréefold, that is Coſmicus, Acronicus, and Heliacus: the ſignification of which words ſhall appeare vnto you by the definitions of the foreſaid thrée kinds héere following. For ortus Coſmicus, called in Latine mundanus, which is as much to ſay, héere as the worldly or morning riſing, is when any ſtar riſeth in the morning aboue the Horizon, together with the Sun, or rather with that point of the Ecliptique line wherein the Sun is at that time. And the Coſmicall ſetting, called in Latine occaſus Coſmicus, is when a ſtarre goeth downe vnder the Horizon at ſuch time as the Sunne riſeth, ſo as this kinde of riſing and ſetting is wholly to be referred to the riſing of the Sunne.

What is *Ortus* and *occaſus Acronicus*?

Ortus Acronicus, which is as much to ſay as the euening or temporall riſing, is when any ſtarre riſeth aboue the Horizon in the euening at the going downe of the Sunne: And occaſus Acronicus, that is to ſay, the euening ſetting, is when any ſtarre goeth downe vnder the Horizon, together with the Sun, and therefore this kind is alwayes to be referred to the going downe of the Sunne, and not to his riſing: and whatſoeuer ſigne or ſtar doth riſe Acronicè, the ſame goeth downe Coſmicè, and whatſoeuer ſtarre doth riſe Coſmicè, the ſame goeth downe Acronicè. And generally all ſtarres that riſe in the day-time, are ſaid to riſe Coſmicè, and all thoſe that riſe in the euening after the Sunne ſet, are ſaid to riſe Acronicè.

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What is *Ortus & occaſus Heliacus*?

Ortus Heliacus, that is to ſay, the Solar riſing, is when any Starre by departing from the beames of the Sun appeareth, and may be ſéene, which before being darkened by the Sunne could not be ſéene. And occaſus Heliacus, is when any Starre by the nigh approching of the Sunne ceaſeth to be ſéene, for by reaſon that the Sun by his yéerely courſe and oblique motion of the Ecliptique, doth ſometimes approch to diuers Starres, and ſometime by little and little, retireth backe againe from the ſame, it falleth out that thoſe ſtars to whom he approcheth, are by nighneſſe of his great light darkened and not ſéene, and by his departing from them, and eſpecially when the Sunne is in the Eaſt or Weſt part of the firmament, they begin againe to be ſéene. And therefore as in the other two kinds, the Horizon together with the riſing and ſetting of the Sunne, are to be conſidered as chiefe cauſes thereof, ſo in this laſt kind the chiefe cauſe is to be referred to the nighneſſe or farneſſe of the Sunne from the ſtarre.

Whereto ſerueth the knowledge of this threefold Poeticall riſing and ſetting of the Starres?

It ſerueth chiefely to vnderſtand thereby thoſe Poets and Hiſtoriographers, which in ſhewing the time of any act done or to be done, doe not ſet downe the day of the moneth, but are wont to deſcribe the time by the riſing or ſetting of ſome notable Starre, which they thinke moſt méete for their purpoſe, and thereby doe greatly adorne their ſtile, and ſpecially being Poeticall: And becauſe that the times wherein ſuch ſtars did riſe or ſet, doe greatly differ in theſe dayes from the ancient times. Many therefore of our moderne Writers, as Garceus and others, haue made diuers Tables of purpoſe to find out the difference, and thereby to come to the true knowledge of the times by the ancient men deſcribed: of which matter I leaue to ſpeake, thinking it not méete to trouble yong Saylers therewith, for whom I chiefely wrote this Treatiſe of the Spheare.

•Yet ſome affirme that the ancient men did vſe the foreſaid Poeticall riſing and ſetting of certayne Starres, and ſpecially of the

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the *Pleiades*, *Hiades*, *Orion*, *Arcturus*, *Capella*, and *Lyra*, (which ſtarres were to them beſt knowne) as a Kalender not only to know thereby the difference of times and ſeaſons of the yeare: but alſo by their manner of riſing, ſetting, hiding, and appearing, to prognoſticate and to fore-ſee tempeſts and ſtormes, yea and that in theſe dayes wee alſo (as ſome write) might doe the like, though there were neither Kalender nor Ephemerides, and in that reſpect the knowledge hereof ſeemeth moſt neceſſary for Mariners.

All ſuch things are to be knowne more exactly by the Aſtronomicall aſcention and deſcention, then by the Poeticall riſing or ſetting of the ſtarres. And you haue to vnderſtand that the ſtars ſince thoſe dayes haue changed their places, their longitudes, and declinations, and thereby in diuers reſpects haue altered their natures and qualities, yea, and the very Signes themſelues: As for example, neither Taurus, Gemini, nor Cancer, is ſo hot and dry now, as in times paſt, neither doth Scorpio cauſe ſo much thunder now, as in times paſt: ſome againe are more or leſſe cold and moyſt then they haue beene heretofore, the cauſes whereof I leaue to the diſcuſſing of the Aſtrologers, and ſo once againe end with this matter.

CHAP. XXXVI.

Of Time, what it is, and into what parts it is diuided.

MOſt men that write of the Spheare, after they haue ſpoken of the aſcentions, doe immediately treate of the diuerſitie and inequalitie of dayes and nights: but ſith dayes, nights, and houres, are but parts of Time, like as bee Weekes, Moneths, and Yeares, I minde heere therefore, firſt briefly to treat of Time, and then of all his chiefeſt parts in order: for if you will be inſtructed at large of theſe matters, then reade the Booke of Iohannes de Sacro-buſto de anni ratione, and alſo Iohannes Garceus his Booke de tempore.

How define you time?

Leauing to ſpeake of time, without time, that is to ſay, euerlaſting and infinite, called of the Latines Eternitas, aſcribed chiefly to God, and therefore not contayned within the moueable Spheares or Heauens: I mind to ſpeake here only of that time, which is a number meaſuring the mouing of the firſt moueable, and of all other mutable things, which time had his beginning with the world, and ſhall end with the ſame: and this time conſiſteth of two parts, that is, firſt and laſt, or rather before or after, ſucceſſiuely following one another, and theſe two parts are knit together with a common bond, called of the Latines Nunc, that is to ſay, now, or at this preſent, which is the end of that which went before, and the beginning of that which followeth after; and therefore ſome doe diuide time into three parts, that is, time paſt, time preſent, and time to come; but the time preſent is a moment indiuiſible, and is the beginning of time, euen as a point or prick is the beginning of all Magnitudes, and yet leaſt part thereof it ſelfe: Againe, time is diuided of ſome into greater or leſſer parts; the greater are ſuch as theſe: Kalends, Nones, Ides, a Weeke, a Moneth, a Yeere, the ſpace of fiue yeeres, called of the Romans, Luſtrum, and of the Greekes, Olympias, the Romans did call it Luſtrum, à luſtrando, that is to ſay, of going about, becauſe that they vſed in the end of euery fiue yeeres, with lights and torches of waxe to goe in proceſſion round about the citie, and did purge the ſame by ſacrificing a Dogge, a Sow, an Oxe, and at that time alſo they did chuſe their Dictator, in a place called the field of Mars, but the ſpace of fiue yeeres called Olympias, tooke his name of the high mount Olympus in Greece, wheras in the end of euery fiue yeeres were celebrated al kind of martial playes, as Fencing, Wreſtling, Running, and ſuch like, in the honour of Iupiter Olympius, alſo the ſpace of fifteene yeeres, called Indictio, in which ſpace thoſe forren Nations that dwelt farre off, and were tributarie to the Romane Empire, paid their Tributes; that is to ſay, In the firſt fiue yeeres, they paid only gold, in token of their obedience to the Empire: In the ſecond fiue yeeres, they paid ſiluer for Souldiers wages, and in the laſt fiue yeeres, they paid braſſe towards the reparation of armour and munition. Item, the ſpace of an hundred yeares, called in Latine ſeculum, and in Engliſh an age, whereof the playes that were celebrated in Rome euery hundred yeare, were called Ludi ſeculares; and laſt of all, the ſpace of a thouſand yeares, called æuum, contayning ten Ages: Againe, the leſſer parts (as Iohannes de Sacro Buſto ſaith) are theſe fiue, the firſt is called in Latine quadrans, which is the fourth part of a day, that is, ſix houres; the ſecond punctus, which is the fourth part of an houre in the Sunnes account, but in the Moones account the fifth part of an houre: the third is called momentum, which is the tenth part of punctus: the fourth is called vncia, which is the twelfth part of momentum: the fifth is called Atomus, which is the eight and fortieth part of vncia. But becauſe in all the greater parts of time there is no greater variation or difference, then in that which in Latine is called annus, and in Engliſh a yeare: I minde heere therefore firſt to treate of a yeare, and then of moneths, weekes, dayes, nights and houres.

CHAP. XXXVII.

Of the yeare & of his diuers kinds, & of the diuers computations had therof in diuers ages, & amongſt diuers Nations.

BE there diuers kindes of differences of yeares?

Yea, indeed, but I will ſpeake heere onely of three kindes or differences, that is, of the great yeare, the Solar yeare, and the Lunar yeare, whereof the two laſt are moſt neceſſarie for our purpoſe.

What is the great yeare?

The great yeare is a ſpace of time in the which not only all the Planets, but alſo all the fixed ſtars that are in the Firmament, hauing ended all their reuolutions, do returne againe to the ſelfe-ſame places in the heauens, which they had at the firſt beginning of the world: and therefore it is called of ſome the yeare of the world, and of ſome the great yeare of Plato, which contayneth according to Alphonſus, 49/000. yeares, whereof we haue ſpoken before, yet ſome affirme that the perfect yeare of the World contayneth but 36000. yeares, whoſe reuolution is after one degree in 100. yeares: but leauing this matter as not greatly profitable, we will ſpeake now of the yeare Solar.

CHAP. XXXI.

Of the Sunnes yeare, called in Latine Annus Solaris, *and of the diuers kinds thereof, and firſt of the Tropicall yeare, both equall and vnequall.*

WHat is the yeare Solar?

It is that ſpace of time, in which the Sun departing from any point of the Ecliptique Line, or from ſome fixed ſtar of the Zodiaque, goeth round about the Zodiaque by his owne proper mouing, which is from Weſt to Eaſt, and ſo returneth againe to the ſelfe-ſame point or ſtar from which he firſt departed, and the Aſtronomers do make diuers diuiſions of the Solar yeare; for firſt they ſay, that it is either Aſtronomicall or Politicall: Secondly, that the Aſtronomicall yeare is either Tropicall or Syderall. Thirdly, that the Tropicall is either equall or vnequall, which vnequall yeare they otherwiſe call the apparant yeare, and true yeare, all which kinds haue in a manner one ſelfe definition, ſauing that the Tropicall yeare taketh his beginning from the vernall Equinoctiall point, and the Syderal yeare from the former ſtarre of the Rams horne, and doe differ chiefely in quantitie.

Shew then what quantitie, that is to ſay, how many dayes houres, and minutes euery ſuch yeare contayneth.

The equall Tropical yeare being counted alwaies from the middle point of the vernall Equinoxe, contayneth 365. dayes, fiue houres $4'9$. $1''5$. and $4'''6$. But the vnequall or apparant Tropicall yeare contayneth ſometime more and ſometime leſſe then the equall yeare, for ſometime beſides the 365. dayes and fiue houres, it amounteth to $5'6$. $5''3$. and $1'''$. ſo as it is more then the equall Tropicall yeare by $7'$. $3''7$. and $1'''5$. and ſometime ouer and beſides the foreſaid 365. dayes and fiue houres, it only contayneth $4'2$. $3''8$. and $2'''7$. which is leſſe then the equall Tropicall yeare, by $6'$. and $3'''$. which vnequalitie chiefely chanceth by reaſon of the vnequall preceſſion of the two Equinoctiall points, before defined in the ſixe and twentieth Chapter.

CHAP. XXXIX.

Of the Syderall yeare, and how much it contayneth.

WHat is the Syderall yeare?

The Syderall or Starrie yeare, is that ſpace of time, wherein the Sunne walking vnder the firmament, departeth from the firſt or foremoſt Star of the Rams horne, and returneth to the ſame ſtarre againe, which ſpace of time alwayes and equally contayneth 365. dayes, ſixe houres, $9'$. and $3''9$. ſo as this yeare is alwayes greater then the Tropicall yeare, and by his equalitie doth alwayes rule and rectifie the inequalitie of the Tropicall yeare.

CHAP. XL.

Of the Politicall yeare, and diuers kinds thereof.

WHat is the Politicall yeare?

It is a yearely ſpace of time which any People or Nation attributeth to the courſe of the Sunne, or of the Moone, or of either of them; which is diuers and manifold, according to the diuers cuſtomes of the nations, of all which I meane not to ſpeake at this preſent particularly, but of certayne ſpeciall and neceſſarie to be knowne, as of the Iulian yeare, of the Egyptian yeare, of the Iewes yeare, and of the Athenian yeare.

CHAP. XLI.

Of the Iulian yeare, and why it is ſo called.

WHat is the Iulian yeare?

The Iulian yeare is that which wee vſe at this preſent day, which of all other yeares draweth nigheſt vnto the Tropicall yeare: for this yeare conſiſteth of 365. dayes and ſixe houres, which ſix houres, if it ſhould be reckoned euery yeare, it would make a great confuſion, and therefore it is reckoned at the end of euery fourth yeare, which yeare conſiſteth of 366. daies, for foure time ſix doth make foure and twentie houres, which is one whole naturall day, whereof that yeare is called the leape yeare: and thereby the Iulian yeare is ſaid to bee two-fold, that is common, contayning 365. dayes, and the other Biſſextile or leape yeare, containing 366. dayes. This word Biſſextile, is deriued of bis & ſextus, becauſe the ſixth day next before the Kalends of March is twice repeated or reckoned, which indeed is the fiue and twentieth of Februarie, vpon which day the Feaſt of Saint Matthias commonly falleth.

Why was it called the Iulian yeare?

Becauſe Iulius Cæſar, the firſt Monarch of the Romane Empire, cauſed the yeare (according to the courſe of the Sun) to be reduced to the number of dayes and houres before expreſſed, who brought an excellent Aſtronomer with him at his comming from Egypt, as well for that purpoſe, as to teach the Mathematicall diſciplines vnto the Romanes: yet you haue to conſider that the Iulian yeare being greater then the Tropicall yeare, doth cauſe great diuerſitie, in that it maketh as well the Equinoctiall and Solſticiall points, as alſo the entrance of the Sunne into the other ſignes by little and litle, to anticipate or to runne before, for whereas in Iulius Cæſars time, the vernall Equinox was the three and twentieth day of March, the ſame Equinox is now about the eleuenth day of March, which is ſooner by twelue dayes.

CHAP. XLII.

Of the Egyptian yeare, and how many dayes it contayneth.

THe Egyptian yeare contayneth the iuſt number of 365. dayes, by reaſon of which equalitie this yeare is very fit to ſerue the Aſtronomers turne in making their Aſtronomicall computations, but the Egyptian yeare hath no certaine place of beginning: For by omitting the ſixe houres which is in the Julian yeare, it doth anticipate in the ſpace of foure yeares one whole day, in ſuch ſort, as 1460. Julian yeares doe make of the Egyptian yeares, 1461.

CHAP. XLIII.

How many Moones the Iewes yeare, and the Athenians yeare doth contayne.

THe Iewes yeare contayneth for the moſt part twelue Moones, & ſometimes thirteene Moones, which kind of yeares did agree with the yeares of the Greekes, and of the Athenians, and alſo of the ancient Romanes before Iulius Cæſars time: and the ancient Romanes did begin their yeare from March; but the latter Romanes from the Winter Solſtice. Againe, the Iewes did beginne their yeare at the firſt new Moone that followed next after the vernall Equinoxe: But the Athenians began their yeare at the new Moone that followed next after the Summer Solſtice: The moſt people of Aſia began their yeare at the Autumnall Equinox: But the moſt part of thoſe that dwell in theſe parts of the World, following the cuſtome of the Romane Church, doe beginne their yeare at the Kalends of Ianuarie, which in old time was not much diſtant from the Winter Solſtice, which Solſtice at

Chriſts birth was the fiue and twentieth of December, but now the ſame Solſtice is about the twelfth day of December, ſo as the Winter Solſtice falleth ſooner by thirteene dayes then it did at that time. But we heere in England do begin the yeare at the fiue and twentieth of March.

CHAP. XLIIII.

Of the yeare Lunar, and of the kinds thereof.

HOw many kinds of Lunar yeares be there, and which be they?

Of Lunar yeares, there be two kinds, whereof the one is ordinary, called in Latine Annus communis, and the other extraordinary or exceſſiue, called by a Greeke name Emboliſmalis, The ordinary or common yeare, is the ſpace of twelue Moones or changes, paſſing by courſe within the yeare Solar, and is called common, becauſe it hath twelue Moones Lunar, euen as the Solar yeare hath twelue moneths Solar, and conſiſteth of 354. dayes and a little more, ſo as the Solar yeare exceedeth the Lunar yeare by eleuen dayes, for the yeare Solar contayneth (as hath beene ſaid before) 365. dayes, in which account the Fractions in both yeares are omitted: And therefore if theſe two yeares ſhould begin together at one ſelfe-time, the Lunar yeare would end his courſe ſooner by eleuen dayes then the yeare Solar.

What is the extraordinary Lunar yeare, called Emboliſmalis?

It is the ſpace of thirteene Moones or changes, contayning 384. daies, ſo as this yeare exceedeth the common Lunar yeare by thirtie dayes, and is more then the yeare Solar by nineteene dayes.

CHAP. XLV.

Of the diuers kinds of monethes, and into what parts euery Solar moneth is diuided according to the Romans, that is, into Kalends, Nones, and Ides.

How many kinds of moneths be there, and which be they?

There be three kinds, that is, the moneth Solar, the moneth Lunar, and the moneth Uſuall.

The moneth Solar, is that ſpace of time which the Sunne ſpendeth in paſſing through any one of the twelue Signes.

The Lunar Moneth, is that ſpace of time which the Moone ſpendeth, while ſhe departing from the Sunne, returneth to him againe.

The Uſuall Moneth, is that number of dayes which are ſet downe in our common Kalenders, whereof ſome contayne thirty dayes, ſome thirty and one, and the moneth of Februarie hath but eight and twenty dayes. But if you will readily know which contayne more dayes, and which leſſe, keepe alwayes in memorie theſe old Engliſh Verſes heere following.

Thirtie dayes hath Nouember,
Aprill, Iune, *and* September:
Februarie *hath twentie eight alone,*
And all the reſt haue thirtie and one.

But when it is leape yeare, Februarie hath nine and twentie dayes: Againe, the Romans diuided the Solar moneth into Kalend, Nones, and Ides.

What be Kalends?

The Kalends, are the firſt day of euery moneth, from which the Romans counted the dayes of the moneth proceeding backward: As for example, the firſt day of Aprill, they named the Kalends of Aprill, and the laſt day of March next before, they called in Latine pridie Kalendas Aprilis, that is, the day before the Kalends of Aprill, and the next day before that, the third

Kalends of Aprill, and the next day before that the fourth Kalends, and ſo forth, vntill they come to the Ides.

Whereof ſprang this name Kalends?

Of the Greeke verbe Calo, which is as much to ſay, as call, for the firſt day of euery moneth the Cryer ſtanding in an high place, made foure calles or more, to ſignifie thereby to the people, how many dayes in that moneth the Faires or Markets called Nundinæ ſhould endure, and of Nundinæ ſprang this word Nonæ, that is to ſay, the dayes of the Faires: For looke how many Nones there were in euery moneth, ſo many Faires there were, during which time the Romans neuer worſhipped any God, becauſe there was no holy-day during that time, and therefore Ouid ſaith, that Nonarum tutela Deo caret, that is to ſay, no God had tuition of the Nones.

What are Ides?

They are thoſe dayes by which the Nones are diuided from the reſt, and theſe Ides doe diuide in a manner the whole moneth into two equall parts, for the firſt Ides moſt commonly falleth either on the thirteenth, fourteenth, or fifteenth day of the moneth.

How many Ides, Nones, and Kalends doe belong to euery moneth?

Of Ides euery moneth hath eight, but of Nones, March, May, Iuly, and October, haue ſix, and all the reſt of the moneths haue but foure Nones, but they differ moſt in the number of Kalends, as you may perceiue by this Table following, which ſheweth how many Kalends, Ides, and Nones, doe belong to euery moneth. Thus farre of the moneth Solar, now I will ſpeake of the moneth Lunar.

The Table.

Moneths.	Kalen.	Ides.	Nones.	Moneths.	Kal.	Ides.	Nones.
Ianuarie.	19	8	4	Iuly.	17	8	6
February.	16	8	4	Auguſt.	19	8	4
March.	17	8	6	September.	18	8	4
Aprill.	18	8	4	October.	17	8	6
May.	17	8	6	Nouember.	18	8	4
Iune.	18	8	4	December.	19	8	4

CHAP. XLVI.

Of the diuers kinds of moneths Lunar.

HOw many kinds be there, and which be they?

Iohannes de Sacro Buſta, ſaith, that there bee foure kinds, that is, the moneth of Paragration, the moneth of Apparition, the moneth Medicinall, and the moneth of Conſecution.

The moneth of Paragration, is that ſpace of time in which the Moone departing from any one point of the Zodiaque, goeth by her proper mouing about the Zodiaque, and returneth againe to the ſaid point from which ſhee firſt departed, which her reuolution is accompliſhed in ſeuen and twentie dayes, and eight houres. And this reuolution of ſome is called a yeare, and by this account the Moone tarryeth in euery ſigne two dayes, ſix houres, and 2′9.

The moneth of Apparition, conſiſteth of eight and twentie dayes, diuided commonly by foure weekes, euery weeke contayning ſeuen dayes, for foure times ſeuen maketh eight and twentie, of which foure weekes, the firſt is counted from her firſt apparance vnto the end of the ſeuenth day, and ſo forth, from weeke to weeke, ſo as the fourth week endeth at the eight and twentieth day, in which account the odde houres during the Moones abode vnder the beames of the Sunne, when as ſhe is ſaid to be combuſt, are not reckoned.

The moneth Medicinal contayneth but ſix and twenty daies and a halfe (as Galen ſaith) and is diuided alſo into foure weekes, the diuiſion being made by minutes.

The moneth of Conſecution is that ſpace of time wherein the Moone being in coniunction with the Sunne, goeth about her Circle, and returneth againe to the ſame point, and not finding the Sunne there, becauſe he hath in that while paſſed through one whole ſigne, ſhee haſteth after, and in two dayes and foure houres, 4′4, and a little more, ſhee ouertaketh the Sunne, and is againe with him in coniunction, of which her following and ouertaking the Sunne, this moneth is called the moneth of Conſecution, which moneth conſiſteth of nine and twentie dayes and a halfe: during which time, as the Sunne by his owne proper courſe paſſeth through one ſigne or thereabouts, ſo the Moone by her courſe, in the ſelfe-ſame time, paſſeth through the whole Zodiaque and one ſigne more: And note by the way, that the Sunne in making his owne proper courſe, doth not enter into any ſigne in the very beginning of any moneth, but rather about the middeſt of euery moneth, or at the leaſt not much ouer or vnder that day.

CHAP. XLVII.

Of a Weeke.

NOw, becauſe that euery moneth, aſwell Solar as Lunar, is diuided into foure weekes, I will ſpeake ſomewhat of a weeke.

What is a Weeke?

A Weeke, called moſt commonly in Latine Septimana, which is as much to ſay, as ſeuen mornings, is the ſpace of ſeuen dayes, whereof the firſt is called Sunday, the ſecond Munday, and ſo forth to Saturday, which names the Gentiles gaue to theſe ſeuen dayes, in honour of the ſeuen Planets, whom they worſhipped as Gods,

Gods, for they called the firſt day the day of the Sunne, the ſecond the day of the Moone, the third the day of Mars, the fourth the day of Mercury, the fifth the day of Iupiter, the ſixth the day of Venus, the ſeuenth the day of Saturne.

Are there any more names belonging to this word, weeke?

Yea, it is called alſo by a Greeke name Hebdoma, that is to ſay, contayning ſeuen dayes, and in the Scripture it is called ſometime Sabbatum, as when the Phariſie ſaid that hee faſted Bis in Sabbato, that is to ſay, twice a weeke, for the Iewes called Sunday the firſt of the Sabbath, and Munday the ſecond of the Sabbath, and ſo forth, in order vntill Saturday, which indeed was their true Sabbath or day of reſt.

Why is it not ſtill ſo counted amongſt vs Chriſtians, but changed into Sunday?

For two cauſes, firſt to auoid the ſuperſtition of the Iewes, and partly it was done in the honour of Chriſt, whoſe day of Birth, Reſurrection, and ſending of the holy Ghoſt, was on the Sunday.

CHAP. XLVIII.

Of dayes and nights both naturall and artificiall.

THe Aſtronomers doe diuide the dayes into two kindes, whereof the one is called naturall, and the other artificiall.

Which call you a naturall day?

A naturall day is one entire reuolution of the Equinoctiall about the Earth, whereunto muſt be added ſuch portion of the Zodiaque, as the Sunne in the meane while maketh by his proper motion, which is from Weſt to Eaſt.

In what time doth the Equinoctiall euery day make his reuolution?

In foure and twenty houres, which ſpace contayneth both day and night, according to which reuolution and number of houres,

houres, the moſt part of Horologies or clocks in the Eaſt country do go, and are ſet to ſhew the houres of the day, but yet diuerſly, for ſome beginne their naturall day at the riſing of the Sunne, as the Bohemians and the Perſians, and ſome at the going downe of the Sun, as the Italians, the Athenians, the Iewes, the Egyptians, and the Arabians, but the Aſtronomers reckon their naturall day from noone-tyde to noone-tyde.

If the Equinoctiall doth make his reuolution iuſt in foure and twentie houres, then all naturall dayes are equall.

That is true, if ye only conſider the motion of the Equinoctiall, but if you adde thereunto (as I ſaid before) that portion which the Sunne in the meane while maketh by his owne proper motion, you ſhall find them to bee vnequall, becauſe that portion is ſometime more, ſometime leſſe, according to the ſwift or ſlow aſcention of the ſigne wherein the Sunne is.

What is the artificiall day?

It is the diſtance or ſpace, that is betwixt the riſing of the Sunne, and going downe of the ſame.

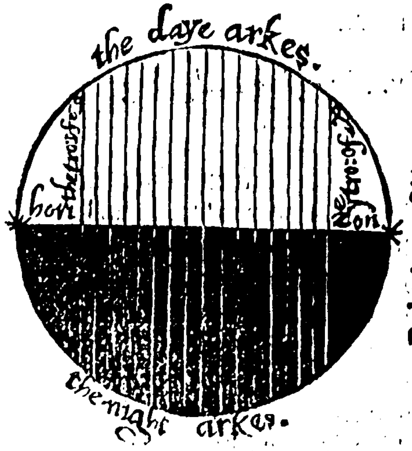
CHAP. XLIX.

The cauſes why the time betwixt the riſing and going downe of the Sunne is vnequall.

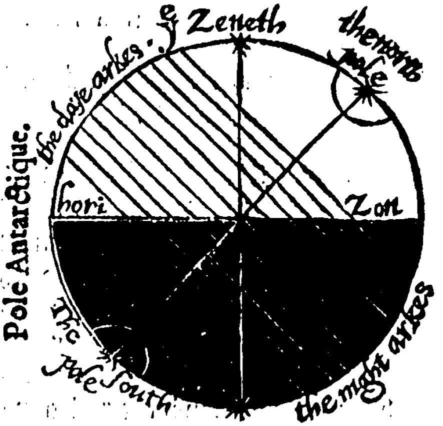
IT muſt needs bee vnequall, becauſe the abode of the Sun aboue the Horizon is variable, as well for the vnequall aſcention and deſcention of the ſignes, as alſo for the obliquitie of the Horizon and Zodiaque: and therefore the ſpaces of the artificiall dayes muſt needs be vnequall: for the Sun as well in aſcending from the beginning of Capricorne, to the beginning of Cancer, as alſo in deſcending from the beginning of Cancer to the beginning of Capricorne, deſcribeth on each part 182. Circles or Parallels, the middle moſt whereof is the Equinoctiall. All which Parallels are diuided into two parts by the Horizon, and the Arkes which are aboue the Horizon

rizon are called the artificiall dayes, and the Arkes beneath the Horizon are called the artificiall nights, which Arkes to thoſe that dwell vnder the Equinoctiall in a right Spheare are alwayes equall, that is to ſay, the diurnall Arke is equall to the nocturnall, becauſe their Horizon paſſeth thorow the Poles of the world, but to thoſe that dwell in an oblique Spheare, aboue whoſe Horizon the Pole is any thing eleuated, bee it neuer ſo little, the Arches or Parallels are vnequal one to another, that is to ſay, either making ſhort dayes and long nights, or elſe long dayes and ſhort nights, the Equinoctiall onely excepted, which as well in the oblique Spheare as in the right, is alwayes diuided by the Horizon into two equall parts, and ſo maketh the dayes and nights equall in all places of the world. All which things you ſhall eaſily comprehend by theſe two figures following, whereof that on the left hand repreſenteth the right Spheare, and the other on the right hand repreſenteth the oblique Spheare.

A figure of the right Spheare.



A figure of the oblique Spheare.



And here I thinke it not amiſſe, to ſhew you how to find out the length of euery artificiall day and night, throughout the yeare, in euery Latitude by the materiall Spheare, and likewiſe

wiſe how to know at what part of the Horizon the Sun riſeth and ſetteth euery day, and alſo how to finde out his Meridian Altitude, whereby you ſhall know how nigh or how farre from your Zenith he is euery day.

Chap. L.

How to find out by the materiall Spheare or Globe, and by helpe of the aſcentionall difference before defined, the increaſe and decreaſe of euery day throughout the yeare in euery ſeuerall Latitude, and at what houre the Sunne riſeth and ſetteth.

FIrſt, hauing ſet the Spheare at your Latitude, learne to know by ſome Table or Inſtrument, in what ſigne and degrée thereof the Sunne is at ſuch day of the month, & yeare as you ſéeke, and bring that degrée cloſe to the moueable Meridian, and there marke in what point or degree the ſaid Meridian cutteth the Equinoctiall, and what number it hath, for ſo ſhal you haue the right aſcention of the degree of the Sun for that day. That done, bring the ſaid degree of [illegible] Sun to the Eaſt part of the Horizon, ſo as it may [illegible] euen with the vpper edge thereof, and ſtaying it there, marke what degree of the Equinoctiall at that inſtant doth alſo touch the Horizon, and what number it hath, and that is the oblique aſcention of the foreſaid degree of the Sunne, then ſubtract the leſſer number out of the greater, and that which remayneth ſhall be the aſcentionall difference, as for example, in this preſent yeare 1590. the eleuenth day of Aprill, the Sun is in the firſt degree of Taurus, whoſe right aſcention in the Latitude two and fiftie, by doing as before is taught, you ſhall finde to bee ſeuen and twentie degrees, and 5′4. and the oblique aſcention thereof to be twelue degrees, 4′8. and the aſcentionall difference to bee fifteene degrees, 6′. which difference you muſt firſt double, and then conuert the ſame into houres and minutes, by allowing fifteene degrees to an houre, and 4. to a degree, that done, adde

thoſe

thoſe houres and minutes to the Equinoctiall day, which is alwayes twelue houres, and the ſumme of that addition will ſhew you the length of the day, when the Sunne is in the firſt point of Taurus, which is fouretéene houres and 1'2. and that is the true length of the day. But you haue to note by the way, that as you haue to adde the ſumme of the houres to the Equinoctiall day, the Sun being in any of the ſix Northerne ſignes, ſo muſt you ſubtract the ſaid houres from the Equinoctial day, the Sun being in any of the ſix Southerne ſignes. As for example, ſuppoſe the Sun to be in the firſt point of Scorpio, the right aſcention whereof is 207. degrées, 5'4. and the oblique aſcention is 223. degrées: héere by taking the leſſer out of the greater, you ſhall find the aſcentionall difference to bee fiftéene degrées, 6'. which being doubled, maketh thirty degrées and 1'2. that is, two houres and 1'2. which if you ſubtract from twelue, there will remayne nine houre 4'8. which is the length of the artificiall day, when the Sun is in the firſt degrée of Scorpio, the one halfe whereof is called the ſemidiurnall Arke of that artificiall day, which is foure houres, 54. minutes, whereby you may gather that the Sun at that time riſeth ſixe minutes after ſeuen of the clocke, and ſetteth againe ſix minutes before fiue: ſo likewiſe in the former example, where the aſcentionall difference was fiftéene degrées, ſix minutes, which being doubled made thirty degrées and twelue minutes, that was two houres and twelue minutes, which being added to twelue houres, made fourtéene houres and twelue minutes, the halfe whereof is ſeuen houres and ſix minutes, whereby you may gather that the Sun did then riſe ſix minutes before fiue of the clocke in the morning, and did ſet ſix minutes after ſeuen of the clock in the euening, and ſo you haue both the forenoone and afternoone of the day, which two times are beſt to be reckoned alwaies from twelue a clock at noone, that is to ſay, the forenoone houres and minutes from twelue backward, and the afternoone houres & minutes from twelue forward, and by ſubtracting the whole length of the artificiall day from foure and twenty houres, you ſhall haue the length of the artificiall night, as in the former example, take fourtéene houres and twelue minutes from foure

and twentie houres, and there will remayne for the length of the artificiall night, nine houres and fortie eight minutes.

CHAP. LI.

How to know by the materiall Spheare or Globe, in what part of the Horizon the Sunne riſeth and ſetteth euery day, and thereby the length of the day. Alſo how to know the Meridian altitude of the Sunne euery day throughout the yeare, and being at his Meridian altitude, to know how farre diſtant he is from the Zenith euery day.

FIrſt, then hauing ſet the Spheare or Globe at your Latitude, which ſuppoſe, to be two and fiftie degrées, bring the degrée of the Sunne for that day to the Eaſt part of the Horizon, ſo as it may méete iuſt with the vpper edge thereof, and there ſet a little péece of waxe vpon the Horizon: that done, turne the ſaid degrée of the Sun to the Weſt part of the Horizon, vntill it méete againe with the vpper edge of the Horizon, and there ſet another péece of wax vpon the Horizon, and thoſe two markes will ſhew you in what part of the Horizon the Sun riſeth and ſetteth: As for example, I would know this preſent yeare 1594. in what part of the Horizon the Sun doth riſe and ſet the twelfth of Iune: héere finding by the Ephemerides that the Sun is entered 1'6. into Cancer at that day, I bring that point of the Ecliptique to the Eaſt part of the Horizon, ſo as it may méete iuſt with the vpper edge thereof, and there I ſet a little péece of waxe vpon the Horizon: that done, I turne the ſaid point of the Ecliptique to the Weſt part of the Horizon, and whereas that point toucheth the vpper edge of the ſaid Horizon, I ſet there another péece of wax vpon the Horizon, then counting the degrées vpon the Horizon, from the true Eaſt point thereof, to the firſt péece of wax Northward, I find the number of degrées to bée fortie degrées or there abouts.

houres, which contayneth thrée points and a halfe, and ſomwhat more, of the Marriners Compaſſe, whereby I gather that the Sun riſeth at that time very néere to the Northeaſt, and ſetteth néere to the Northweſt, becauſe the number of the degrées in both parts of the Horizon are like.

How ſhall I know how many points of the Marriners Compaſſe, are contayned in any number of degrees, exceeding the number of degrees and minutes contayned in one point?

The Mariners Compaſſe contayneth two and thirty points, and euery point contayneth eleuen degrées and $\frac{1}{4}$ of a degrée, which is fiftéene minutes, wherefore, whenſoeuer you would know how many points of the Compaſſe are contayned in any number of degrées, be it great or ſmall, multiply that number by foure, and diuide the product thereof by 45. and the quotient will ſhew the number of the points, and if there were any remaynder, then becauſe the Mariner doth make euery point to haue foure quarters, multiply that remaynder by foure, and diuide the product by 45. which is the common Diuiſor, and the quotient will ſhew the quarters, or if the remaynder be but ſmall, then multiply that remaynder by eight, which are halfe quarters, and diuide the product thereof by 45. as before, and the quotient will ſhew the halfe quarters of a point: as in the former example in multiplying fortie degrées by foure, the product is 160. which if you diuide by 45. you ſhall find in the quotient thrée whole points, and the remaynder to be twentie fiue, which being multiplyed by foure, the product will be an hundred, which if you diuide by 45. you ſhall find in the quotient two quarters of a point, and the remaynder to be $\frac{10}{45}$ of a quarter, that is to ſay, if you can diuide one quarter in 45. parts, then you muſt take ten of thoſe parts, and adde them to the former ſumme, which being of ſmall importance is not to bée regarded. But now to returne to my firſt matter, I ſay, that by counting the degrées vpon the Horizon, from the firſt péece of way to the South point of the Horizon, I find the number of degrées to bee 130. degrées, and by allowing fiftéene degrées to an houre, I find the halfe day to contayne eight houres 1'0. which being doubled, maketh ſixtéene houres 2'0. Then to know the Meridian altitude of the Sunne, you muſt bring the degrée of the Sunne right vnder the Meridian, and the number of the degrées contayned in the Meridian betwixt the South point of the Horizon, and the ſaid degrée of the Sunne, will ſhew the Meridian Altitude of the Sunne, ſo ſhall you find the Meridian Altitude of the Sunne being in the firſt point of Cancer, to be ſixtie one degrées, which once had, the diſtance from the Zenith is ſoone knowne: for if you ſubtract ſixtie one degrées from ninetie, you ſhall find the diſtance of the Sunne from the Zenith to bée nine and twentie degrées. Againe, contrariwiſe the diſtance of the Zenith being ſubtracted from ninetie, the remaynder will ſhew the Meridian Altitude, for thoſe two numbers being added together, doe alwayes make a iuſt quarter of the great Circle, which is ninetie degrées.

CHAP. LII.

Of houres as well equall as vnequall, and into what parts they are diuided.

AS of dayes and nights there be two kinds, that is, Naturall and Artificiall, before defined, ſo likewiſe are there two ſorts of houres, that is, Equall and Vnequall: An equall houre is the foure and twentieth part of a Naturall day, and euery ſuch houre contayneth fiftéene degrées of the Equinoctiall, for fiftéene times foure and twentie maketh 360. degrées, which is the whole Circuit or Longitude of the Equinoctiall, which according to the Diurnall mouing of the firſt moueable, maketh his reuolution in foure and twentie houres, as hath béene ſaid before, and therefore this equall houre is alſo called an Equinoctiall or Naturall houre. The vnequall houre is the twelfth part of an artificiall day or artificiall night, which dayes and nights as they bée ſometimes long and ſometimes ſhort, according to the time of the yeere, ſo are the houres of the ſame. For both day and night, be it neuer ſo ſhort, is diuided by the Aſtronomers into twelue houres, ſo as when here in ſome part of England towards the North, the artificiall day is ſeuenteene houres long, and the night but ſeuen houres, if you diuide either of theſe into twelue parts, you ſhall find that euery ſuch twelfth part of the day ſhall contayne more then the naturall or Equinoctial houre by 2′5. and the twelfth part of the ſaid artificial night to contayne but the one halfe of an equall houre and fiue minutes, which notwithſtanding being both added together, will make in all foure and twentie equall houres, which is a naturall day: ſo as by this meanes you may eaſily perceiue that a naturall day comprehendeth both kinds of houres, as well vnequall as equall. Note alſo, that the vnequall houres are called ſometime artificiall, and ſometime temporall houres; artificiall, becauſe they are daily changed by the varietie of the artificiall dayes and nights, and are neuer equall but twice in the yeare, when the Sunne is in either of the Equinoxes: and they are called temporall, becauſe the ancient obſeruers of time were wont to make diuers Clocks and Horologies, to ſhew theſe vnequall and temporall houres, of which Clocks there are yet ſome to be ſeene at this day. Moreouer, the houres both equall and vnequall are diuided not only into quarters of houres, but alſo into minutes: for euery houre be it long or ſhort, is diuided into ſixtie minutes, and euery minute into ſixtie ſeconds, and euery ſecond into ſixtie thirds, and ſo forth to fourths, fifths, ſixths, and into as many as you will, ſo as you make your diuiſion alwayes by ſixtie. But you haue to note, that as the Aſtronomers doe diuide the artificiall day and artificiall night into houres, both equall and vnequall, ſo the Iewes doe diuide each of them into foure quarters, in manner and forme following.

CHAP. LIII.

How and in what manner the Iewes doe diuide the artificiall day and night, each of them into foure quarters.

THey diuide the artificiall day into foure quarters, by allowing to euery quarter three houers accounting the firſt houre of the firſt quarter at the riſing of the Sun, and the third houre of the ſaid quarter, they called the third houre, and the third houre of the ſecond quarter, they called the ſixth houre, which was midday or noonetyde: againe, they called the third houre of the third quarter, the ninth houre, and they called the ſecond houre of the fourth quarter, the eleuenth houre, and they called the laſt houre which was the twelfth houre of the day, euen-tide, becauſe then the Sun went downe.

Whereto ſerueth the knowledge hereof?

By knowing this account, you may the better vnderſtand certaine places of the Scripture, making mention of things done at certaine houres not like vnto our common houres. For whereas it is ſaid in the Goſpell of Saint Iohn, that Chriſt healed the Rulers ſonne that was ſicke of an Ague in Capernaum, and that the Ague left him the ſeuenth houre, is as much to ſay, as the Ague left him at one of the clocke in the afternoone: Againe, whereas mention is made in the Goſpell of Saint Matthew, of the labourers that came to worke in the Vineyard at the eleuenth houre, is to bee vnderſtood at fiue of the clocke in the afternoone, or rather one houre before the Sunne ſet, for you muſt thinke that the Sunne riſeth not, nor yet goeth downe in Iewrie, alwayes at ſixe of the clocke, for then they ſhould haue no artificial day nor night, but all daies and nights ſhould bee alike. Alſo they diuided the artificiall night into foure quarters, otherwiſe called by them the foure watches of the night: for the firſt three houres was the firſt watch, during which time, all the Souldiers both young and old of any fortified Towne, were wont to watch: the ſecond three houres they called the ſecond watch, which was about the dead of the night, at which time the yong Souldiers only watched, and the third quarter of the night contayning alſo thrée houres, and was called the third watch, the Souldiers of middle age did watch, and the laſt thrée houres called the fourth watch, which was about the breake of day, the old Souldiers only watched. But now becauſe the ancient Aſtronomers doe appoint the gouernment of the vnequall houres to the ſeuen Planets, it ſhall not bee amiſſe to ſhew you héere what Planet raigneth euery houre both day and night.

CHAP. LIIII.

How to know what Planet raigneth in euery houre of the Day or night artificiall, as well by helpe of a Table, as by a rule contayned in one Verſe.

BUt firſt, I will deſcribe vnto you the Table, and then briefly ſet downe the vſe thereof. In the firſt columne of this Table on the left hand are ſet downe the ſeuen daies of the wéeke, whereof the firſt is Sunday, and the ſecond Munday, and ſo forth downeward to Saturday: againſt euery which day the Planets are placed towards the right hand, euery one in courſe one after another, and in the firſt row of this Table which is the head or front thereof, are placed the houres of the day written in Arithmetical figures, and in the next row of the ſaid front, are ſet downe the houres of the night, written as you ſée in common numerall Letters.

The Table.

Houres of the Day.	1	2	3	4	5	6	7	8	9	10	11	12		
Houres of the Night.	iij	iiij	v	vi	vij	viij	ix	x	xi	xij			i	ij
Sunda.	☉	♀	☿	☽	♄	♃	♂	☉	♀	☿	☽	♄	♃	♂
Mund.	☽	♄	♃	♂	☉	♀	☿	☽	♄	♃	♂	☉	♀	☿
Tueſd.	♂	☉	♀	☿	☽	♄	♃	♂	☉	♀	☿	☽	♄	♃
Wedn.	☿	☽	♄	♃	♂	☉	♀	☿	☽	♄	♃	♂	☉	♀
Thurſd.	♃	♂	☉	♀	☿	☽	♄	♃	♂	☉	♀	☿	☽	♄
Friday.	♀	☿	☽	♄	♃	♂	☉	♀	☿	☽	♄	♃	♂	☉
Saturd.	♄	♃	♂	☉	♀	☿	☽	♄	♃	♂	☉	♀	☿	☽

The vſe of the Table.

NOw the vſe of the ſaid Table, is thus: whenſoeuer you would know what houre of the day or night any Planet reigneth, you muſt firſt ſéeke out the houre of the day or night, and if it bée of the day, then you ſhall find it in the firſt row of the front, if of the night, in the ſecond row of the front, as hath béene ſaid before: and from that houre deſcend with your finger to the common Angle, ſtanding right againſt the day which you ſéeke, and that will ſhew you what Planet then reigneth. As for example, if you would know on Wedneſday at the eight houre of the day, what Planet reigneth, then hauing found the number of eight in the front, written in Arithmeticall figure, come ſtraight downe from thence with your finger to the common Angle, ſtanding right againſt Wedneſday, and you ſhall find that Mercurie reigneth. And if you would know what Planet reigneth the ſame day at the eighth houre of the night, then deſcend from the houre of the night downe to the common Angle, and you ſhall find that the Sunne reigneth, and ſo forth of all the reſt.

The rule contayned in one Verſe, and the vſe thereof.

The rule in Verſe is thus:
Sol, Ve, Mer, Luna, Saturnus, Iupiter, and Mars.

Theſe ſeuen words (the coniunction and being left out) doe ſignifie the ſeuen Planets: For Sol is the Sunne, Ve. ſtandeth for Venus, Mer. for Mercurius, Luna is the Moone, and the other thrée Planets following, as Saturnus, Iupiter, and Mars, doe make vp the number of ſeuen, which muſt alwayes follow one another, in ſuch order as they are héere ſet downe in the foreſaid Verſe; and to haue the true vſe of this Rule, you muſt firſt apply euery Planet to his owne proper day, as Sol to Sunday, Luna to Munday, Mars to Tueſday, Mercurius to Wedneſday, Iupiter to Thurſday, Venus to Friday, and Saturnus to Saturday: for euery one of theſe Planets gouerneth the firſt houre of his owne proper day, and the Planet placed next to him in the Verſe, gouerneth the ſecond houre of the ſame day, and ſo forth, orderly, as for example. If you would know what Planet ſhall reigne on Sunday at the third houre of the day, you muſt firſt ſay that Sol doth reigne the firſt houre becauſe that is to day; and Venus reigneth the ſecond houre, and Mercurie the third houre, according to your rule, and ſo by kéeping the order of the Verſe, you ſhall eaſily appoint to euery houre, both of the day and of the night, artificiall his owne gouernour: For, though both day and night bée diuided each of them into twelue houres, making in all foure and twentie houres, and that there bée but ſeuen Planets, yet by appointing euery Planet to his owne proper day as gouernour of the firſt houre of the ſame day, and by obſeruing the order of the Verſe in repeating the ſaid Planets, you ſhall not faile to giue to euery houre his proper Planet. This ſufficeth, when the dayes and nights are equall, viz. of twelue houres a péece, which is onely in March and September, when the Sunne is in the Equinoctiall, but if the day or night conſiſt of more or leſſe then twelue houres, then there muſt bée an equalitie of parts made betwixt the day and the night, for howſoeuer that the day may be ſixtéene houres, and the night but eight, and either of them more or leſſe, yet muſt each of them bée diuided into twelue equall parts or planetarie houres: for when the day is ſixtéene houres long, then will the planetarie houre, or the twelfth part of that day be eightie minutes, or one naturall

houre

houre and 20′. at which time the night being but eight houres, the twelfth part thereof or Planetarie houre will be but 40′. of a naturall houre: and if you would at any time conuert the ordinary houres of the day into Planetarie houres, thereby to know the length of a Planetary houre, how long or ſhort ſoeuer the day or night is, multiply the houres of the day or night by ſixtie, and to the product adde the odde minutes, if there be any, that total diuide by twelue, the quotient ſheweth the number of minutes that each Planetary houre ſhall contayne.

Thus hauing ſufficiently ſpoken of the Celeſtiall
part, I will now procéed to the Elemental
part of the world, contayned
in the ſecond Bóoke of
this Treatiſe.

THE SECOND PART OF THE SPHEARE.

CHAP. I.

Of the Elementall part of the World.

WHat doth the Elementall part containe?

I told you before, that as the Celeſtiall part doth contayne the eleuen Heauens before deſcribed, ſo the Elementall part contayneth the foure Elements, that is to ſay, Fire, Ayre, Water, and Earth, which are of themſelues pure ſubſtances, and the firſt and next beginnings, whereof all mixt bodies are compounded, and therfore not to be ſéene with our outward eyes, for as we our ſelues are bodies compound, ſo with our outward ſenſes wee can diſcerne nothing but that which is compound: and therefore the fire, ayre, water, or earth which we daily féele or ſée, are not the Elements themſelues, but things compounded of them. The natures & properties of which Elements I mind here but briefly to touch, ſith the exact handling thereof belongeth rather to naturall Philoſophers and to Phyſitians, then to Geographers, who haue to deale only with the ſituations of the Earth, with Zones, Parallels, Climes, Longitudes, Latitudes, Diſtances, and ſuch like things belonging to the meaſure and deſcription of this earth héere which we inhabite.

Define theſe Elements?

CHAP. II.

Of the Fire, and of his nature and motion.

THe Fire is an Element moſt hot and dry, pure, ſubtill, and ſo cléere as it doth not hinder our ſight, looking thorow the ſame towards the ſtars, and is placed next to the Spheare of the Moone, vnder the which it is turned about like a celeſtiall Spheare.

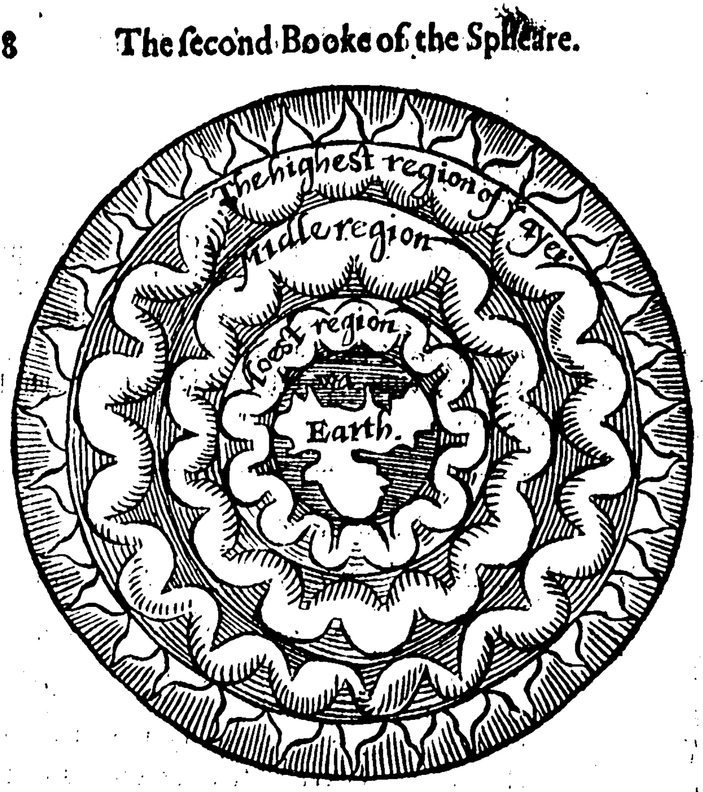
CHAP. III.

Of the Aire, and into how many Regions it is diuided.

NExt to Fire is the Ayre, which is an Element hot and moyſt, and alſo moſt fluxible, pure and cleare, notwithſtanding it is farre thicker and groſſer, as ſome ſay, towards the Poles, then elſe-where, by reaſon that thoſe parts are fartheſt from the Sunne: and this Element is diuided of the naturall Philoſophers into thrée Regions, that is to ſay, the higheſt Region, the middle Region, and the loweſt Region, which higheſt Region being turned about by fire, is thereby made the hotter, wherein all fierie impreſſions are bred, as Lightnings, Fire-drakes, blazing-ſtars and ſuch like.

The middle Region is extreame cold by contrarie oppoſition, by reaſon that it is placed in the middeſt betwixt two hot Regions, and therefore in this Region are bred all cold watry impreſſions, as Froſt, Snow, Ice, Haile, and ſuch like.

The loweſt Region is hot by the reflex of the Sunne, whoſe beames firſt ſtriking the earth, do rebound backe againe to that Region, wherein are bred clouds, dewes, raines, and ſuch like moderate watery impreſſions, which thrée Regions of the Aire, with the reſt of the Elements, this figure doth plainly ſhew.



CHAP. IIII.

Of the Water, and whether it be round or not.

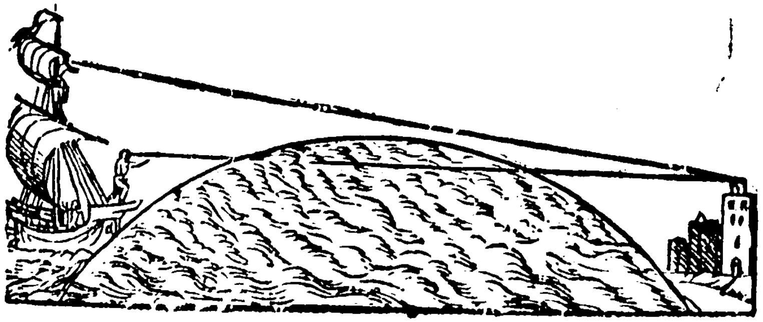
NExt to the Ayre, is the Water, which is cold, moyſt, and fluxible, and being lighter then the Earth would of his owne nature ſurmount and couer the whole earth, had not God in the creation of the world diuided waters frō waters (as the Booke of Gen. ſaith) and gathered together thoſe waters that are vnder the firmament, into certaine concauities of the earth, leauing other parts of the earth dry and diſcouered, that man and beaſt might inhabite the

ſame,

ſame, and haue feede neceſſarie for their behoofe, ſo as now both Water and Earth doth make one entire and Sphearicall body, which is enuironed with the Ayre.

Is not the Water a round body of it ſelfe without the Earth?

Many late Writers doe denie the whole bodie to be round, affirming onely the Conuex ſuperficies or vpper face of the Water to be round: for (ſay they) the Earth being not altogether round, the Concaue ſuperficies of the Water cannot bee round, notwithſtanding the moſt part of the ancient Writers doe affirme the whole body of the Water to be round, ſaying, that the Water hath the like ſhape in his whole, that it hath in his parts: For the parts which are drops, are round, ergo, the whole is round. Againe, they proue the Water of the Sea to bee round, by demonſtration, thus: ſuppoſe a ſhip to depart from the ſhore whereon ſome marke is ſet, which you may ſee with a right leuelled line ſtanding at the ſterne of the ſaid ſhip, but ſayling farther from the ſhore, you cannot ſee the marke any more ſtanding vpon the ſterne, but ſhall be fayne to goe vp to the top of the Maſt to ſee it, by reaſon that the Water being a round body, riſeth and ſwelleth in the middeſt, and ſo letteth your ſight, as this figure plainly ſheweth.

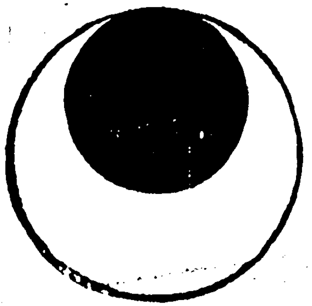


CHAP.

CHAP. V.

Of the Earth, and whether it be all round or not.

NExt to the Water is the Element of the Earth, which of his nature is thicke, heauy, cold, drie, and not fluxible, as is the Water and Ayre, but is firme and apt to keepe his place. And though ſome denie the Earth to bee round, becauſe of the high Mountaines, and deepe Dales and Vallies therein, which are nothing in compariſon of the whole Earth, to alter that roundneſſe which it hath by Nature, yet Ariſtotle affirmeth in his ſecond Booke, de Cœlo & Mundo, the fourteenth Chapter, that the Earth of his owne nature is round, prouing the ſame as well for that the Moone when ſhee is eclipſed in part, could not haue ſuch horned ſhape as this figure repreſenteth, vnleſſe the Earth were alſo round, by the interpoſition whereof ſhee is eclipſed, either totally or in part, as hath beene ſaid before. Againe, hee proueth the roundneſſe of the Earth by the altering of the Horizon, for in going from North to South, our Horizon altereth in ſuch ſort as we diſcouer thoſe ſtars which we could not ſee before, but were cleane hidden from our ſight. Some alſo denie, that the Earth is in the middeſt of the World, and ſome affirme that it is mooueable; as alſo Copernicus, by way of ſuppoſition, and not for that hee thought ſo indeed: who affirmeth, that the Earth turneth about, and that the Sunne ſtandeth ſtill in the middeſt of the Heauens, by helpe of which falſe ſuppoſition he hath made truer demonſtration of the motions and reuolutions of the celeſtiall Spheares, then euer were made before, as plainly appeareth by his booke de Reuolutionibus, dedicated to Paulus Tertius the Pope, in the yeare of our Lord, 1536. But Ptolomie, Ariſtotle, and all other old writers affirme the earth to be in the middeſt, and to remayne vnmoueable, and to be in the very Center of the World, prouing the ſame with many moſt ſtrong reaſons not needfull heere to be rehearſed, becauſe I thinke few or none doe doubt thereof, and ſpecially the holy Scripture affirming the foundations of the Earth to be laid ſo ſure, that it neuer ſhould moue at any time: Againe, you ſhall find in the ſelfe-ſame Pſalme theſe words. Hee appointed the Moone for certaine ſeaſons, and the Sunne knoweth his going downe, whereby it appeareth that the Sunne moueth and not the earth. But leauing this matter, we will now ſpeake of the compaſſe of the earth, and of the longitude and latitude thereof.



CHAP. VI.

Of the compaſſe of the Earth, and of the diuerſitie of Meaſures acording to diuers Countries.

CAn the whole Earth be meaſured?

Yea very well: for ſith the earth and the water (as hath bin ſaid before) doe make together one whole Sphearicall or round bodie, and that euery great Circle as wel therof as of the Heauens, contayneth 360. degrees, there is no more then to be done, but to allow for euery ſuch degree ſixtie Italian myles, which differ not much from our Engliſh myles, ſo as in multiplying 360 degrees by ſixtie, you ſhall finde the whole compaſſe of the earth to be 21600. miles: of which compaſſe if you would know the true Diameter, then hauing multiplyed the ſaid compaſſe or circuit of 21600. miles by ſeuen, diuide the product therof by two and twentie, and the quotient together with the remaynder, will ſhew the true Diameter, which is 6872. miles, fiue furlongs, and $\frac{9}{11}$ of a furlong, and the halfe of that is the ſemidiameter of the earth, which is 3436. miles, and $\frac{4}{11}$ of a mile: and as the Italians & we Engliſh-men in meaſure great diſtãces on the earth by miles, ſo the French, the

the Spaniſh, and the high Almaines, do meaſure ſuch diſtances by leagues, both by land and ſea, and euery one differeth from other: for the French league contayneth two of our miles, the Spaniſh league three, and the common league of Germanie, foure, and the great league of Germanie contayneth fiue of our miles, yea in ſome places of Germanie, as in Sueuia, the leagues are ſo long as a man ſhall ſkant ride three of them in a whole day. Againe, the Grecians did meaſure the diſtances of the earth by Furlongs, the Ægyptians by Signes, and the Perſians by Paraſanges, all which meaſures doe greatly differ euen in the ſmalleſt parts, from whence all meaſures do take their firſt originall: for as well amongſt the ancient men, as amongſt them of latter dayes, foure barley kernels couched cloſe together ſide by ſide, and not end-long, are ſaid to make a finger breadth, and three finger breadthes an ynch, and three ynches a palme or hand breadth, and three palmes or nine ynches a ſpan, and foure palmes or hand breathes a foote, and two foote and a halfe to make a common pace, and fiue foot to make a Geometricall pace, of which kind of paces, 125. doe make a Furlong, and eight Furlongs doe make an Italian mile, and foure ſuch miles do make a common Germane league, as hath beene ſaid before: But by reaſon that the barley kernels be not in al cou̅tries of like bigneſſe; neither finger breadthes, ynches, handbreadthes, feet, nor any of the other meaſures are found any where to be equall: for the French foot of Paris is longer then ours by an ynch, and the Italian foot is longer by two ynches and more, and yet their miles are ſomewhat ſhorter then ours: and the Germane foot (according to Stophlerus) is leſſe then ours, by two ynches and a halfe. But to ſhew the diuerſitie of meaſures would require a long Diſcourſe more intricate then profitable, and therefore I leaue to talke any further thereof, wiſhing you when we ſpeake of Miles, Furlongs, Paces, or Feet, to conſider the meaſure thereof according to the ynch or foot of our Engliſh Standard.

CHAP.

CHAP. VII.

Of the Longitude and Latitude of the Earth.

WHat meane you by the Longitude and Latitude of the Earth?

Longitude is as much to ſay as length, and Latitude ſignifieth breadth, for ſith the Earth is a body, it muſt needs haue both length, breadth, and depth.

How define you ſuch Longitude and Latitude, and how is it to be counted?

The Longitude of the Earth in generall, is that ſpace or vpper face of the Earth, which extendeth from Weſt to Eaſt, and againe, from Eaſt to Weſt: And the Latitude in generall is that ſpace which extendeth North and South, euen from the one Pole to the other. Now to know how ſuch Longitude and Latitude is to bee accounted, you muſt firſt vnderſtand, that the Equinoctiall Circle, girding the Earth in the very middeſt, is diuided into 360. degrees, by reaſon of certayne Meridians which paſſing thorow the Poles of the world, do cut each halfe of the Equinoctial in eighteene points, which being doubled do make 36. ſpaces, euery ſpace contayning ten degrees: and ſome do diuide the Equinoctiall with 36. Meridians, cutting each halfe thereof into 36. points, which being doubled do make 72. ſpaces, euery ſpace contayning fiue degrees, which commeth all to one reckoning: for fiue times 72. doe make 360. as well as ten times 36. of which Meridians, bee there neuer ſo few or many (for you may, if you will, make halfe as many Meridians as there be degrees in the Equinoctiall, which amounteth to 180.) yet according to Ptolomie, that Meridian is ſaid to bee firſt and furtheſt Weſtward, which paſſeth thorow the Ilands, called Inſulæ Fortunatæ, for the Weſt Indies were not knowne nor diſcouered in his dayes, nor yet long time after; ſince the diſcouerie whereof, the late Coſmographers of theſe dayes, doe make the firſt Meridian to paſſe thorow the

Ilands

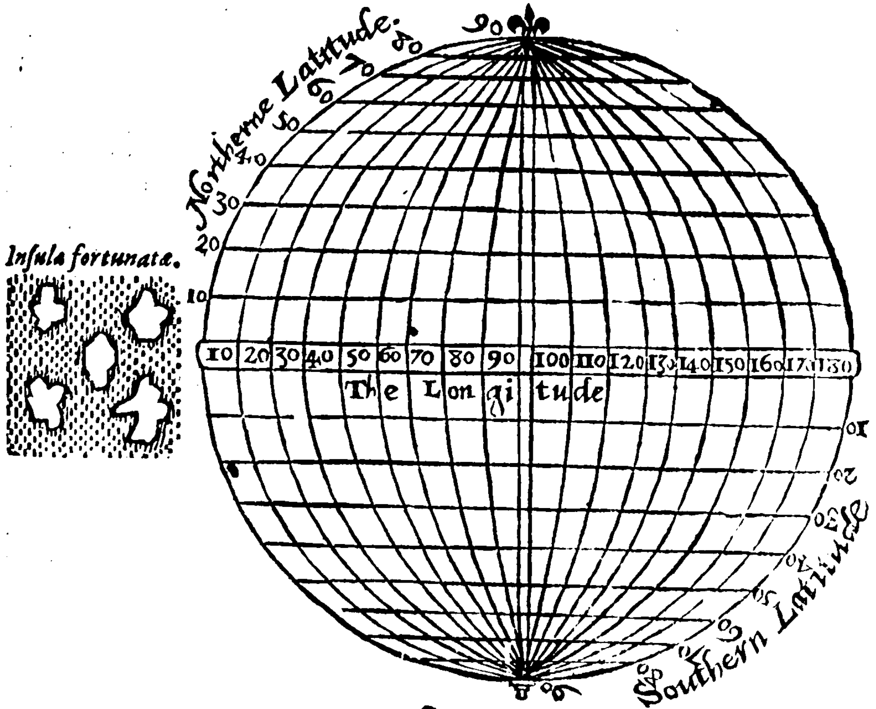
Ilands called Azores, which Ilands, as appeareth by their Cards, are ſituated more Weſtward from the foreſaid Inſulæ fortunatæ, by fiue degrées, the reaſon that moueth them ſo to doe, is becauſe the Mariners Compaſſe, as they ſay, will neuer incline to the true North Pole, but when they ſaile either by the Ile Saint Marie, or Saint Michael, affirming that in euery other place the Compaſſe doth varie from the true North, either by Northeaſting or Northweſting. And by thus altering the ancient placing of the firſt Meridian, they muſt likewiſe alter all the Longitudes ſet downe heretofore by Ptolomie, or any other ancient Writer. Notwithſtanding the matter is eaſily holpen, for by adding to euery Longitude Eaſtward fiue degrées, or by ſubtracting fiue degrées from euery Longitude Weſtward, you ſhall not greatly varie from thoſe ancient longitudes that be truly ſet downe. But to returne againe to my firſt purpoſe, I ſay, that whereſoeuer this firſt Meridian cutteth the Equinoctiall, there beginneth the firſt degrée of longitude, which procéedeth Eaſtward vntill you come to 180. degrées, which being the one halfe of the earth, is as far as you can goe Eaſtward, for then the earth being round, you muſt néeds turn againe Weſtward vntill you come to the 360. degrées which is the laſt degrée of longitude, and endeth where the firſt degrée beginneth: and therefore the Coſmographers meaſuring alwayes the longitude by the degrées of the Equinoctiall, doe define lõgitude to be that portion of the Equinoctial circle, which is contayned betwixt the firſt Meridian and the Meridian of any place ſuppoſed, but the diſtance betwixt any two ſuppoſed Meridians (neither of them being the firſt Meridian,) is not called of them longitude, but the difference of longitude: For ſuppoſe the diſtance of the one Meridian, to be twentie degrées diſtant from the firſt Meridian, and the other but ten, theſe longitudes you ſée are not like, but doe differ, and therefore the diſtance betwixt any ſuch two places may be very wel called the difference of longitude, and not longitude it ſelfe, which hath alwayes regard to the firſt Meridian, and to none other.

Define once againe what Latitude is?

Latitude is none other thing, but the diſtance of any place from

from the equinoctial, either towards the north pole, or towards the ſouth pole, ſo as there be 2. kinds of latitudes, the one northerne, & the other ſoutherne: & ſuch latitude is meaſured vpon the Meridian, which paſſeth thorow many places ſuppoſed. For euery Meridian is alſo diuided into 360. degrées, and by reaſon that the Equinoctial girdeth al ſuch Meridians in ỹ very midſt, it diuideth them all into foure equall quarters, euery quarter contayning 90. degrées, which is the greateſt latitude that any place can haue, as you may ſée in this figure following: whereof the firſt Meridian on the left hãd is put to ſignifie, according to Ptolomie, that which paſſeth thorow the fortunate Ilãds, or by the Azores, according to ỹ moderne Coſmographers (if you wil haue it ſo) containing ỹ degrées of the latitude, both northward and ſouthward: and thorow the midſt of al the Meridians paſſeth the Equinoctial, contayning the degrées of the Longitude.

The figure of the Longitude and Latitude of the World.



What be the other manifold Circles in this figure, diuiding the Meridians on each ſide of the Equinoctiall, as well towards the North Pole, as towards the South Pole?

They are called Parallels, whereof we ſhall ſpeake in the ſeuenteenth Chapter: in the meane time marke well this Figure, that thereby you may the better conceiue what is the Longitude and Latitude of the Earth.

Vnderſtanding now the Longitude and Latitude of the whole earth, I am deſirous to know how the Longitude and Latitude of euery ſeuerall place of the Earth or Sea is to bee found out, and how farre any place is diſtant one from another.

CHAP. VIII.

How to know the Latitude of any place, as well in the day as in the night.

BEcauſe the Latitude of any place is more eaſie to be found (as moſt men think) then the Longitude, I will firſt treate of Latitude. The Latitude then is to bee knowne by the Aſtrolabe, Quadrant, Croſſe-ſtaffe, and by ſuch like Mathematical inſtruments, and that diuers waies, whereof the moſt eaſie is thus. Firſt, w̄ your Aſtrolabe or Quadrant, or any ſuch like inſtrument, take the height of the Sunne right at noone, when the Sun is in the firſt point of Aries or of Libra. which height if you ſubtract from ninetie, that which remayneth is the true Latitude of that place. But if you would know the Latitude at any other day or time of the yeare, then after that you haue taken the height of the Sun at noone, otherwiſe called the Meridian Altitude, you muſt firſt learne to know the true degree of the Suns declination by the Table of the declinations before ſet downe, together with the vſe thereof in the thirteenth chapter of the firſt Booke, or by ſome other Table more lately calculated: and if ſuch declination be Northernly, then you muſt ſubtract that from the foreſaid altitude or height: but if the declination be Southernly, then you muſt adde the ſame vnto the foreſaid height, and by ſuch ſubtraction or addition, you ſhall haue the height of the Equinoctiall aboue your Horizon, which being ſubtracted from ninety, that which remayneth is the true latitude of that place: & to be ſure in taking the Meridian altitude, it ſhall be needfull to take it diuers times one after another, with ſome little pawſe betwixt, to ſee whether it increaſeth or decreaſeth, for if it doth increaſe, then it is not yet full noone, but if it decreaſeth, then it is paſt noone. This laſt way of finding out the latitude, is, and hath bin moſt commonly taught, as well by the ancient, as moderne Writers, as a moſt ſure and readie way of finding the Latitude of any place.

What if the Sun do not ſhine at noon, nor perhaps al that day?

Then you muſt tarry vntill night that ſome ſtarre appeare, which you perfectly know, and ſuch a one as both riſeth and ſetteth. And hauing taken the Merididian altitude of that ſtarre with your Aſtrolabe or Quadrant, you muſt learne what declination he hath, and whether it be Northerne or Southerne. For if the ſtarre hath North declination, then you muſt ſubtract his declination from his Meridian altitude, and the remaynder ſhall be the Altitude of the Equinoctiall, which being taken out of ninetie, ſhall be the Latitude of the place, or eleuation of the Pole: but if the declination of the ſtarre be Southernely, then you muſt adde his declination to his Meridian Altitude, and that ſumme ſhall be the Altitude of the Equinoctial, which being taken out of ninety, the remaynder ſhal be the eleuation of the Pole. As for example, ſuppoſing that you know the ſtarre called Arcturus or Bubulcus, and that you find his Meridian altitude by your Aſtrolabe or Quadrant to bee fiftie nine degrees thirtie minutes, and alſo that you haue learned by ſome Table, that his declination to the Northward is one and twentie degrees, thirtie minutes: here by taking his ſaid declination becauſe it is Northernely, out of his Meridian altitude, you finde the remaynder to bee thirtie eight degrees, which is the altitude of the Equinoctiall, which being taken from 90. the remainder will be 52. degrees, which is the Latitude of that place whereas you made your obſeruation, and this is a farre more readie way, then to waite all night to take the Meridian altitude, and alſo the depreſſion of ſuch a ſtarre as neuer ſetteth, which is ſeldome done in one ſelfe-night. And therefore I would wiſh all Mariners to acquaint themſelues with many ſtarres that doth both riſe and ſet, and ſo ſhall they be ſure to find one ſuch ſtarre or other, to be at his Meridian altitude at any houre of the night that they deſire, if the ſtarres doe ſhew.

CHAP. IX.

How to know the Longitude of any place.

Though the longitude may bee found out by diuers wayes not eaſie for euery mans capacitie, yet becauſe Gemma Friſius thinketh none ſo ſure as to know the ſame by the Eclipſe of the Moone, (which alſo as hee ſaith) may ſometime faile by reaſon of the diuerſitie of aſpects and latitude of the Moone, and for that cauſe hath inuented a more readie way to find out at all times the longitude of any place, I minde heere therefore briefely to ſhew you firſt the order of finding out the Longitude by the Eclipſe of the Moone, and then how to finde out the ſame by that readie way which hee hath inuented: the order then to know it by the Eclipſe of the Moone is thus: Firſt, you muſt learne by ſome Ephemerides at what houre the Eclipſe ſhall bee in ſome place, where you know alreadie by ſome Table the Longitude: that done, you your ſelfe, or ſome other for you, muſt the ſame day of the Eclipſe obſerue by the Aſtrolable at what houre the Eclipſe beginneth in that place, whereof you know not the Longitude: For if the Eclipſe do beginne in both places at one ſelfe-houre, then aſſure your ſelfe that both places haue one ſelfe Longitude, but if it beginne ſooner or later, then there is difference betwixt them according to the varietie of the time, which difference is thus to be knowne: take the leſſer ſumme of houres out of the greater, and there ſhall remayne either houres, or minutes, or both; if houres, then multiply the ſame by fifteene; if minutes, diuide the ſame by foure (for in this account, fifteene degrees do make one houre, and foure minutes do make one degree) and adde the difference ſo found to the Longitude, if the Eclipſe do appeare there ſooner; if later, then ſubtract the ſaid difference from the knowne Longitude, and that which remayneth will ſhew the vnknowne Longitude. But note by the way, that if there remayne any minutes after the diuiſion, you muſt multiply thoſe minutes by fifteene, and ſo ſhall you haue the minutes of degrees.

Shew the vſe of this rule by ſome example.

For example; I find by the rule of Ptolomie, that the longitude of Paris in France, is three and twentie degrees, and by ſome Almanacke or Ephemerides, I find that the Eclipſe doth beginne there at three houres after midnight: now by this I would know the longitude of Tubing, a famous citie in Sueuia, which is a region of Germanie, at which towne, in the very day of the Eclipſe, I cauſe to bee obſerued by Aſtrolabe, at what houre the Eclipſe beginneth there, and I find that it beginneth at three of the clocke and 24′. after midnight: then by ſubtracting the leſſer number of time out of the greater, I find the remaynder to be 24′. which being diuided by 4′. which doe make one degree, the quotient ſhall be ſixe degrees, and that is the difference, which being added to the knowne longitude of Paris, (becauſe the Eclipſe is ſooner there than at Tubing) it maketh in all nine degrees; whereby I gather, that the longitude of Tubing is nine and twentie degrees. By this meanes all the Tables of Coſmographers are moſt commonly made, and yet many times they greatly differ in their Longitude, for lacke perhaps of vſing diligence in taking the right houre and moment of the Eclipſe, and for not duly conſidering the diuers aſpects, and what latitude the Moone hath at that inſtant, which may cauſe great error.

CHAP. X.

A ready way to find out the Longitude of any place, inuented by Gemma Friſius.

That way is done by the helpe of ſome true Horologie or Watch, apt to be carried in iourneying, which by an Aſtrolabe is to bée rectified, and ſet iuſt at ſuch houre as you depart from the place where you are, to goe to any other place, whereof you are deſirous to know the Longitude: in which your going you muſt bée diligent to ſée that your Watch neuer ceaſe going, and being arriued at that place whereof you ſéeke to know the Longitude, you muſt tarrie vntill the Index doe iuſtly touch the pricke of ſome perfect houre, and alſo at that inſtant, to ſée what houre it is by your Aſtrolabe: for if your Aſtrolabe and Watch doe both agrée in one, then aſſure your ſelfe that there is no difference of Longitude, but that you haue trauelled ſtill vnder one ſelfe Meridian, either towards the North or South. But if they differ one houre or certayne minutes, then reduce them to degrées, or to the minutes of degrées, in ſuch order as is before taught, and thereby you ſhall find the Longitude which you deſire to know. But to take the Longitude of any place vpon the Sea by this manner of way, moſt men thinke it were a great deale better to doe it by the helpe of a great houre-glaſſe, made to runne foure and twentie houres, which muſt bée watched when it is readie to runne out, that it may bée immediately turned: for, Watches made of Iron or Steele, will ſoone ruſt vpon the Sea.

CHAP. XI.

Another way taught by Appian *to finde out the Longitude of any place with the Croſſe-ſtaffe, by knowing the diſtance betwixt the Moone and ſome knowne Starre, that is ſituated nigh vnto the Ecliptique Line.*

Firſt, ſéeke to know by the Aſtronomicall Tables the true mouing of the Moone, according to the Longitude, at that time of your obſeruation, at ſome certaine place, for whoſe Meridian the roots of thoſe Tables are calculated and verified. Alſo you muſt know the degrée of Longitude, of ſome fixed ſtarre nigh vnto the Ecliptique, going either next before or elſe next after the mouing of the Moone, then you muſt ſéeke out the diſtance of the mouing of the Moone, and of the ſaid ſtarre, which diſtance once had, apply the Croſſe-ſtaffe to your eye, and moue the croſſe vp and downe, vntill you may ſee the center of the bodie of the Moone with the one end of the croſſe, and the foreſaid fixed Starre with the other end of the croſſe: ſo ſhall the croſſe ſhew you by the degrees and minutes marked vpon the ſtaffe, the diſtance of the Moone and of the fore-ſaid ſtarre, anſwerable to the place of your obſeruation; which being ſet downe, ſet downe alſo the diſtance betwixt the Moone and the fore-ſaid ſtarre that was firſt calculated, and then take the leſſer out of the greater, ſo ſhall remayne the laſt difference, which may be rightly called the diuerſitie of aſpects: which difference if you diuide by the mouing, which the Moone maketh in one houre, you ſhall know therby the time in which the Moone is or was ioyned with the firſt diſtance of the foreſaid ſtarre, then hauing conuerted that time into degrees and minutes, adde or ſubtract the product thereof to or from that Meridian, vnto which the Tables (wherby you firſt calculated the mouing of the Moone) were verified, that is to ſay, if the diſtance betwixt the Moone and the fixed ſtarre of your obſeruation be leſſer, then adde the degrees and minutes to the knowne longitude, ſo ſhall you find the place of your obſeruation to be more Eaſtward, but if it bee greater, then ſubtract the degrees and minutes from the knowne longitude, and the place of your obſeruation ſhall be more Weſtward. All which Rules, Gemma Friſius affirmeth to be true, ſo as the Moone be more Weſtward then the fixed ſtarre: for if at the time of your obſeruation, the Moone be more Eaſtward, then you muſt work cleane contrarie; that is to ſay: if the diſtance betwixt the Moone and the fixed ſtarre be leſſer, you muſt ſubtract the degrees and minutes from the knowne Longitude, ſo ſhall the place of your obſeruation bee more Weſtward: but if it bee greater, then you muſt adde the degrees and minutes vnto the knowne Longitude, and you ſhall find the place of your obſeruation to be more Eaſtward.

CHAP. XII.

How to know the diſtance of places, that is to ſay, how many miles one place is diſtant from another, and how many wayes places are ſaid to differ in diſtance one from another.

THe diſtance may be knowne diuers wayes, that is either Arithmetically, Geometrically, or by the Tables of Sinus. But before I ſhew you the order of any of theſe wayes, you haue to vnderſtand, that any two places doe differ in diſtance one from another, one of theſe three manner of wayes; that is, either in latitude only, or in longitude only, or elſe in both. If two places hauing one ſelfe-longitude, doe differ onely in latitude; then according to the Arithmeticall way, you muſt ſubtract the leſſer latitude out of the greater, and the remainder ſhall be the difference, which being multiplyed by ſixtie, will ſhew the number of miles: as for example, London and Roan hauing in a manner one ſelfe-longitude, do differ onely in latitude, for the latitude of London is one and fiftie degrees, 32′.

and

and the latitude of Roan is fortie nine degrees and 10′. which being the leſſer latitude, and therefore to bee taken out of one and fiftie degrées, 32′. there remayneth two degrées, 22′. which two degrées being multiplyed by ſixty, maketh 120. whereunto if for the 22′. annexed to the degrees, you adde two & twentie miles (for euery minute is a mile) it ſhall make in all 142. miles, which by a right line is the true diſtance betwixt London and Roan. But you haue to note that the difference of two ſundry latitudes is not to be knowne by ſubtracting the leſſer out of the greater, vnleſſe both the places bee ſo ſituated, as both haue either North latitude, or South latitude: for if the one place haue North latitude, and the other South latitude, the difference is to be knowne by addition, and not by ſubtraction. As for example, Naples in Italy hath one and fortie degrées of North latitude, and la Madelena in Affricke, not farre from Manicongo, hath eight degrees of South latitude, both places hauing one ſelfe Meridian. Here the difference of theſe two latitudes is to be knowne by addition, and not by ſubtracting the leſſer out of the greater, for eight and one and forty being added together, doe make nine and fortie, and that is the true difference, which being multiplyed by ſixty, maketh 2940 miles. So likewiſe the difference of the two longitudes, is not alwayes knowne by ſubtracting the leſſer out of the greater, vnleſſe the two places haue both Eaſt longitude, or elſe both Weſt longitude. As for example, Lisbona in Spain hath in Eaſt longitude thirtéene degrées, and Cap de los ſlauos in the Weſt Indies, hath in Weſt longitude 334. degrées: here the difference of theſe two longitudes is not to bee knowne, by taking the leſſer out of the greater, but thus: firſt take 334. out of 360. and there will remayne ſix and twentie degrees, whereunto if you adde the Eaſt longitude for Lisbona, which is thirteene degrees, it will make in all nine and thirty degrees, which is the true difference of the two longitudes, for if you ſhall take thirteene degrees out of 334. there would remayne 321. which is not the true difference. But to know the diſtance of two places differing in longitude, this Table heere following is néedfull.

The

The Table of Miles anſwerable to one degree of euery ſenerall Latitude.

D.	M.	S.	D.	M.	S.	D	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.
	1			2			3			4			5			6	
1	59	59	16	57	41	31	51	26	46	41	41	61	29	5	76	14	31
2	59	58	17	57	23	32	50	53	47	40	55	62	28	10	77	13	30
3	59	53	18	57	4	33	50	19	48	40	9	63	27	14	78	12	28
4	59	51	19	56	44	34	45	45	49	39	22	64	26	18	79	11	27
5	59	46	20	56	23	35	49	9	50	38	34	65	25	21	80	10	25
6	59	40	21	56	1	36	48	32	51	37	46	66	24	24	81	9	23
7	59	33	22	55	38	37	47	55	52	36	56	67	23	27	82	8	21
8	59	25	23	55	14	38	47	17	53	36	7	68	22	29	83	7	19
9	59	16	24	54	49	39	46	38	54	35	16	69	21	30	84	6	16
10	59	5	25	54	23	40	45	58	55	34	25	70	20	31	85	5	14
11	58	54	26	53	56	41	45	17	56	33	33	71	19	32	86	4	11
12	58	41	27	53	28	42	44	35	57	32	41	72	18	32	87	3	8
13	58	28	28	52	59	43	43	53	58	31	48	73	17	33	88	2	5
14	58	13	29	52	29	44	43	10	59	30	54	74	16	32	89	1	3
15	57	57	30	51	58	45	42	26	60	30	0	75	15	32	90	0	0

Deſcribe this Table.

This Table is diuided into ſixe columnes, euery columne contayning, firſt the degrees of Latitude, and then the miles and ſeconds of miles, anſwerable to euery degrée: for euery degrée of the very Equinoctiall it ſelfe is in value ſixtie miles, but the further you goe from the Equinoctiall either Northward or Southward, euery degree of Latitude is leſſer in value then other, and contayneth fewer miles, as you may eaſily ſée by the ſaid Table, proceeding from one degree to ninetie, which is the greateſt Latitude that any place can haue.

Chap.

Chap. XIII.

How to know by the helpe of the foreſaid Table, the diſtance of two places, differing onely in Longitude.

You muſt multiply the difference of the Longitudes by the number of miles, anſwerable to the Latitudes of the ſaid places, omitting alwaies the ſeconds of miles ſet downe in the ſaid Table, becauſe in this account they are of ſmall importance: as for example, London and Antwerpe, hauing both in a manner one ſelfe Latitude, doe differ onely in Longitude ſixe degrées 42′. which difference being multiplyed by 37. miles, anſwerable to 51. degrées of Latitude, as you ſée in the Table, doe make in all 247. miles and 54″. of a mile. But in making this multiplication, you muſt firſt multiply the ſixe whole degrées by 37. and the product thereof will amount to 222. then by the rule of proportion you may find out the value of the minutes annexed to the degrées of the difference of Longitude, in ſaying thus, if 60′. which is one degrée, doe require 37. miles, what ſhall 42′. require. And by working according to the rule of proportion, you ſhall find the fourth number which you ſéeke to be 25. miles and 54″. which being added to the firſt product 222. maketh in all 247. miles and 54″. of a mile, which wanteth but 6″. to make vp another mile.

Chap. XIIII.

How to find out the true diſtance of two places, differing both in Longitude and Latitude, by the Arithmeticall way.

How is that done?

Firſt, take the difference of the longitudes & latitudes of both places, by ſubtracting the leſſer out of the greater, then conuert the ſame into miles by multiplying the difference of the two Longitudes into the miles, that be anſwerable

to

to the Latitude of each place, which miles you ſhall find in the Table aforeſaid, and if there bée any minutes annexed to the degrées of the difference of Longitude, then reduce the ſame alſo to miles, by the rule of proportion, as before is taught, and hauing added the two products together, halfe the ſumme, and ſet it by it ſelfe. Then multiply the difference of the Latitudes into ſixtie miles, and adde thereunto the Fraction of minutes annexed to the ſaid difference, if it hath any fraction, following for euery minute one mile, and ſet that number alſo by it ſelfe: that done, ſquare the ſummes reſerued, that is to ſay, multiply each one part by it ſelfe into it ſelfe, and hauing added the two products together into one ſumme, ſéeke out the ſquare roote thereof, and that ſhall be the true diſtance of the two places. As for example, if you would know the true diſtance betwixt London and Venice, firſt you muſt know by ſome Table the Longitude and Latitude of both Townes, wherefore finding the Longitude of London to be ninetéene degrées, 54′. and the latitude thereof to be 51. degrées, 32′. And the longitude of Venice to be 35. degrées, 30′. and the latitude thereof to be 44. degrées, 45′. Now by ſubtracting the leſſe longitude ont of the greater, I find the difference of longitude to bée fiftéene degrées, 36′. and by ſubtracting the leſſer latitude out of the greater, I find the difference of latitude to be ſixe degrées, 47′. Then knowing the latitude of London to be 51. degrées, I reſort to the Table of miles, appointed for euery degrée of latitude before ſet downe, and there I find that to 51. degrées of latitude doe anſwer 37. miles and certayne ſeconds, which being of ſmall moment, are not wont to bée reckoned. Then in multiplying the difference of the longitudes, which is ſiftéene degrées, 36′, by 37. miles, I find the product of the fiftéene degrées ſo multiplyed, to be 555. and becauſe there be 36. annexed to the foreſaid fiftéene degrées, I ſéeke by the rule of proportion to know how many miles that fraction contayneth, in ſaying thus; if ſixtie require 37. what ſhall 36. require? and I find two and twentie miles: which being added to 555. maketh 577. then by ſéeking in the foreſaid table, how many miles be anſwerable to the latitude of Venice, which is 44. degrées, I

find

find the number of miles to be 43. by which number I multiply once againe the difference of longitude, which is fiftéene degrées, 36′. the product whereof, together with the fraction annexed thereunto, being conuerted into miles by the rule of proportion, as before doth amount to 670. which ſumme being added to the former conuerted longitude, which is 577. maketh in all 1247. the halfe whereof is 623. ½. which halfe number I reſerue by it ſelfe: that done, I multiply the difference of the latitude, which is ſix degrees 47′. by ſixtie miles in ſaying, ſixe times ſixtie maketh 360. whereunto I adde for the 47′. annexed 47. miles, and it maketh in all 407. which ſumme I reſerue alſo by it ſelfe. Then I multiply the firſt reſerued number into it ſelfe, the product whereof is 388. 129. That done, I multiply the ſecond reſerued number alſo into it ſelfe, the product whereof is 165649. which two laſt products being added together, doe make in all 553778. whereof the ſquare root being taken, is 744. miles, which is the true diſtance of Venice by a right Line from London. And to the intent that the order and working herein may more plainly appeare vnto you, I haue ſet downe all the particular numbers of the ſame héere by themſelues, as it were in a Table.

	Longitude.	Latitude.
London.	19. degrees, 54′.	51. degr. 32′.
Venice.	35. degrees, 30′.	44. degr. 45′.
The difference of their Longitudes and Latitudes.	15. degrees, 36′.	6. degr. 47′.
The difference of the Longitudes conuerted into miles: for London is		577
For Venice.		670
The ſumme of the two conuerted Longitudes added together, is		1247
The halfe whereof, which is the firſt reſerued number, is		623

The

The ſecond reſerued number, which is the difference of the latitudes, conuerted into miles, is	407
The ſumme of the firſt reſerued number multiplyed into it ſelfe, is	388129
The ſumme of the ſecond reſerued number multiplyed into it ſelfe, is	165649
The ſumme of both added together, is	553778
The ſquare root whereof, which is the ſumme of the miles, is	744

Chap. XIIII.

How to find out the diſtance betwixt two places, differing both in longitude and latitude by helpe only of a demicircle, diuided into 180. *degrees without any Arithmeticke.*

BUt now becauſe the way before taught, to finde out ſuch diſtance by the Arithmeticall way may ſéeme perhaps to folkes very buſie and tedious, I haue thought good therfore to ſet downe this other way which was ſent me not long ſince from my louing friend Maſter Wright, of Caius Colledge in in Cambridge, who is well learned in the Mathematiques, and is ſo apt thereunto by nature, as he is like enough to attaine to ſuch perfect knowledge therin, as he may be able thereby hereafter greatly to profit his Country, if for want of ſufficient exhibition he be not forced to leaue ſo noble a ſtudie. Wherefore I wiſh with all my heart that all Gentlemen of abilitie were minded to ſhew their liberalitie towards him in that behalfe. But to returne to my matter, I ſay that the way to finde out the foreſaid diſtance is this héere following: firſt, hauing drawn a demicircle vpon a right Diameter (the larger that the demicircle is, the better) and diuided the ſame into 180. degrées, like vnto this hereafter deſcribed, and marked with the Letters A.B.C.D. whereof D. is the center, and A.C. the Diameter;

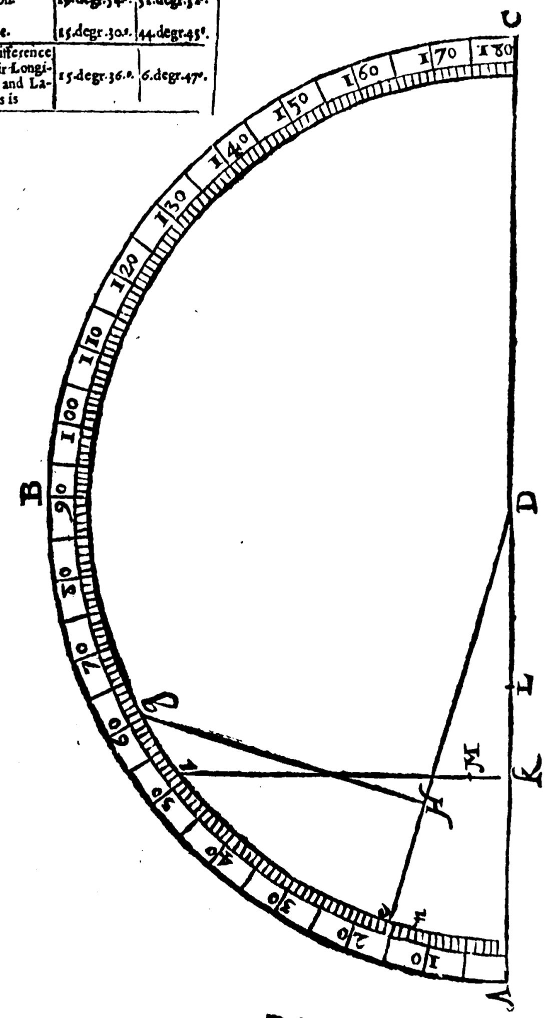
Then

Then learne firſt by ſome Table to know the Longitude and Latitude of both places, and the difference of their Longitudes, as you did before in ſéeking to know by the Arithmeticall way the diſtance betwixt London & Venice, the difference of whoſe two longitudes is fiftéene degrées, and 36'. as you may ſée in the former Table: for in working by this way, you haue chiefely to ſéeke out in the Circumference of the demicircle but thrée things, that is, firſt, the difference of the two Longitudes: ſecondly, the leſſer Latitude: and laſt of all, the greateſt Latitude. Knowing therefore the difference of the ſaid two places in Longitude, to be fiftéene degrées, 36'. ſéeke out the ſame in the Demicircle, beginning to count at A. and ſo procéed towards B. And at the end of thoſe degrées and minutes, ſet downe a pricke marked with the letter e. vnto which pricke draw a right line by your ruler from D. the centre of the demicircle. That done, ſéeke out the leſſer Latitude, which is foure and fortie degrées, and 45'. in the foreſaid demicircle, beginning to account the ſame from the pricke e. and ſo procéed towards the letter B. and at the end of the ſaid leſſer Latitude, ſet downe another pricke marked with the letter g. from which pricke or point, draw a perpendicular line, which by helpe of your ſquire or compaſſes may fall with right Angles vpon the former right line drawne from D. to e. and where it falleth, there ſet downe a pricke marked with the letter h. That done, ſéeke out the greater Latitude, which is one and fiftie degrées, and 32'. in the foreſaid demicircle, beginning to account the ſame from A. towards B. and at the end of that Latitude ſet downe another pricke marked with the letter l. from whence draw another perpendicular line, that may fall by helpe of your ſquire or compaſſe with right angles vpon the Diameter A.C. and there make a pricke marked with the letter K. That done, take with your compaſſe the diſtance that is betwixt k. and h. which diſtance you muſt ſet downe vpon your ſaid Diameter A.C. ſetting the one foot of your compaſſe vpon k. and the other towards the centre D. and there make a pricke marked with the letter L. Then take with your compaſſe the length of the ſhorter perpendicular line g.h. and apply that

wideneſſe

wideneſſe vpon the longer perpendicular line I. K. ſetting the one foot of your compaſſe at I. which is the end of the greater Latitude, and extend the other foot towards K. and there make a pricke marked with the letter M. That done, take the diſtance betwixt L. and M. with your Compaſſe, and apply the ſame to the Demicircle, ſetting the one foot of your Compaſſe in A. and the other towards B. and there make a pricke marked with the letter N. And the number of degrées contayned betwixt A. and N. will ſhew the true diſtance of the two places, which you ſhall find to be twelue degrées, and almoſt 24'. Now by allowing for euery degrée ſixtie miles, and for euery minute a mile, the ſumme of miles will agrée with the former diſtance found out by the Arithmeticall way, which was 744. miles. And thus you haue to deale to know the diſtance of any other two places whatſoeuer, differing both in Longitude and Latitude. But you haue to note by the way, that if the difference of the Longitudes doth excéed the number of 180. then you muſt ſubtract that excéeding difference out of 360. and the remaynder ſhall be the difference of the Longitudes, and then worke in all points, as is before taught. And this way is as Geometricall, as that which Appian ſetteth downe in his booke of Geographie, to be done by helpe of the terreſtriall Globe, the order whereof héere followeth.

London.	19.degr.54'.	51.degr.32'.
Venice.	15.degr.30'.	44.degr.45'.
The difference of their Longitudes and Latitudes is	15.degr.36.'.	6.degr.47'.



CHAP. XV.

How to find out the diſtance of the places by the Geometricall way.

HOw is that done?

Moſt readily and eaſily by helpe of a terreſtriall Globe in this manner following. Firſt, take the diſtance of the two places by extending your compaſſe vpon the Globe, from the one place to the other, which if you would know how many miles it comprehendeth, apply the ſame diſtance ſo taken vnto the Equinoctiall Line, ſetting the firſt foot of your Compaſſe vpon the firſt Meridian in that point, whereas it cutteth the Equinoctiall: then ſee how many degrees of the Equinoctiall are comprehended betwixt the two feet of your Compaſſe, and multiply thoſe degrees by 60. and the product thereof ſhall ſhew you how many Italian miles ſuch diſtance is in length. But if either of the places, or both, bee wanting and not expreſſed in the Globe, then you muſt learne by the Tables of Ptolomey or of ſome others, as of Appian, Gemma Friſius, Orontius or ſuchlike, the Longitude and Latitude of the ſaid places: that done hauing ſought out the Longitude of the firſt place in the Equinoctiall, turne the Globe about with your hand vntill you haue brought the Longitude right vnder the Brazen Meridian, which being ſtayed there, ſeeke out in the ſaid Meridian the Latitude of the ſaid place, and there ſet a marke vpon the Globe, for there the place ſhould ſtand, and doe in like manner to find out the ſecond place: Then by extending your Compaſſe from the one marke to the other, you ſhall haue the true diſtance, which diſtance if you apply to the Equinoctiall, like as before is taught, the degrees thereof being multiplyed by 60. will ſhew you how many miles thoſe two places are diſtant one from another.

May not the diſtance of places be found out as well by an vniuerſall Map as by the Globe terreſtriall?

Yes indeed and more readily, by reaſon that for the moſt

part euery Map hath his proper Scale, ſo as you need to doe no more but to take the diſtance of the two places with your Compaſſe, and to apply the ſame to the Scale, ſhewing the miles or leagues.

What if the Map haue no Scale?

Then you muſt ſeeke out the diſtance by ſuch meanes as I doe ſhew in my Treatiſe of the vſe of vniuerſall Maps.

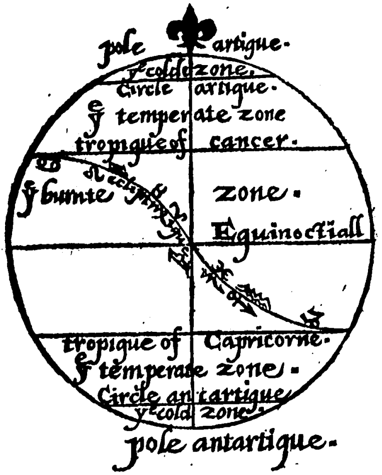
I pray you in the meane time proceed inſhewing me the third way of finding out of the diſtance of places, which you ſaid was *per tabulas Sinuum*?

The order of finding out the diſtance of two places differing both in Longitude and Latitude per tabulas Sinuum, is plainly ſet downe before in the end of my Arithmeticke, whereas I do make a plaine deſcription of the ſaid Tables, and do ſhew the vſe thereof as well by this as by diuers other examples, wherefore I wiſh you to reſort to that Treatiſe, and you ſhall haue your deſire. For hauing for this time ſufficiently ſpoken of the Longitude, Latitude and diſtance of places, and how the ſame is to be found out, I thinke it meet to treat of the fiue Zones, of Climes and Parallels, whereinto the ancient Coſmographers thought good to diuide the Earth, to the intent that euery part thereof might be the better knowne how it is ſituated either Northward or Southward, whether it be hot or cold, or betwixt both, and of what length the day and night is in euery place, and what manner of ſhadow the Sunne yeeldeth euery where, and ſuchlike accidents: and firſt of the fiue Zones.

CHAP. XVI.

Of the fiue Zones.

THe moſt ancient Coſmographers conſidering how the Sunne by his oblique, and variable courſe, did warme with his beames one part of the earth more then another, gathered thereby that the Earth had three temperatures, that is to ſay, extreame hot, extreame cold, and a meane temperature, that is, neither too hot, nor too cold: And therefore to ſhew vs vnto which of theſe temperatures, any part of the Earth was ſubiect, they diuided the Earth into fiue Zones, anſwerable to the fiue Zones of the Firmament, by helpe of the Equinoctiall and the foure leſſer Circles before deſcribed in the firſt part of this Treatiſe, the twentieth Chapter, and are there ſet forth in Figure, which Figure I thought good to ſet downe againe in this place, to the intent you might the better remember what was ſaid there touching the Zones.



But other Coſmographers comming afterward, not ſatiſfied with the fiue Zones, becauſe they ſhew nothing but the ſituation & the thrée temperatures of the earth, did diuide the Earth into certaine Climes and Parallels, to finde out thereby the length of the day and night in euery place, and the true Latitude thereof, as Ptolomey and many others after him haue done, making ſuch diuiſions as wee ſhall ſpeake of hereafter. But truly I thinke with Mercator, that the beſt and moſt exact way of diuiding the Earth to ſerue all purpoſes is to be made by degrées and minutes, wherein is leſſe error then in Climes and Parallels, neither can Climes or Parallels be ſo well deſcribed when you draw nigh to any of the Poles, for that the ſpaces as well betwixt the Parallels as betwixt the Meridians do grow continualy ſtraighter and ſtraighter, as you may ſée in the figure of Parallels hereafter following.

I remember that in the twentieth Chapter where you deſcribed the fiue Zones, you ſaid that the ancient men did greatly erre in affirming three of the Zones to be vnhabitable, that is, the two cold Zones, and the hot Zone, I pray you therefore ſhew me here the cauſe why they erred?

They erred for lacke of experience, becauſe they had neuer trauelled into thoſe Regions: but in theſe latter dayes men of diuers Nations, eſpecially the Spaniſh, Engliſh, French, and Flemmiſh, haue trauelled very farre, ſome towards the North Pole, and ſome towards the South Pole, and alſo through the burnt Zone; for thoſe that ſaile from the North parts towards the South Pole, or from the South parts towards the North Pole, muſt néedes paſſe in their Voyage thorow the burnt Zone: and theſe men doe affirme that they haue found all the thrée Zones, that is to ſay, the two cold and hot Zones to bee well inhabited. And our late Coſmographers do not let to render cauſe why they ſhould be habitable: for (ſay they) though the cold bee very extreme in thoſe Regions that lye next vnto the Poles, yet the Sun appearing and giuing ſhine vnto them both day and night, doth greatly qualifie and moderate the extreme cold of thoſe regions. But truly, in mine opiniõ, they haue ſmal comfort of the Sun, ſith it ſtriketh almoſt round about their féet without yéelding any warme reflex from aboue, & eſpecially to thoſe that do inhabit nigh to either of the Poles. Againe, they ſay that the burnt Zone is habitable, by reaſon that the night to them is continually as long as the day, the cooleneſſe whereof doth greatly refreſh the extreme heate of the day. But now let vs returne to our purpoſe, and ſpeake ſomewhat of the

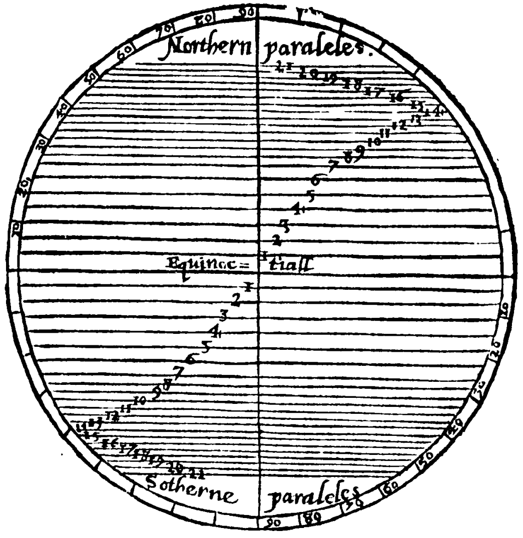
Climes and Parallels, and becauſe euery Clime conſiſteth of two Parallels, I thinke it beſt to ſpeake firſt of Parallels.

CHAP. XVII.

Of Parallels.

WHat be Parallels?

Parallels bee Lines either right or circular, alwayes equally diſtant one from another, ſo as they can neuer méete. And of Parallels that are to be conſidered in the Spheare, ſome make thrée kinds, according to their thréefold ſignification: for ſome are called the Parallels of the Sunne, who in departing from the Equinoctiall towards any of the Poles, maketh euery day throughout the yeare one Parallel, ſo as in going from the Equinoctiall to the Tropique of Cancer, he maketh 182. Parallels: and as many againe in going from the Equinoctiall to the Tropique of Capricorne. The ſecond kind of Parallels are called the Parallels of Latitude. And the third the Parallels of the longeſt day; which two laſt are in effect both one. For the further that any Parallel is ſituated from the Equinoctiall towards either of the Poles, the more Latitude it hath, and ſo by conſequent maketh the day longer to thoſe that dwell vnder that Parallel: of which Parallels the ancient Coſmographers do make in all but one and twentie, procéeding proportionally either towards the North Pole or South Pole, as you may ſée by this Figure hére following; the middle Line or Circle whereof is the Equinoctiall.



And euery Parallel procéeding from the ſaid Equinoctiall, either Northward or Southward, doth lengthen the day by one quarter of an houre in ſuch proportion as this Table hére following ſheweth, appointing to the firſt Parallel, and next vnto the Equinoctiall foure degrees and 1′5. and to the ſecond Parallel eight degrées, 3′0. and ſo forth vntill you come to the one and twentieth Parallel paſſing thorow Iſland, which Parallel is diſtant from the Equinoctiall ſixtie thrée degrées 1′6. further then which Parallel Northward, the Tables of Prolomie doe not extend, and Southward they extend no further then to that Parallel which hath leſſe then twentie degrées of Latitude.

The Table of Parallels ſhewing how many degrees and minutes euery one is diſtant from the Equinoctiall, made according to the rule of Ptolomie.

Parallels	D.	M.	Parallels	D.	M.	Parallels	D.	M
the firſt	4	15	the eight	30	45	fifteene	48	40
the ſecond	8	30	the ninth	33	40	ſixteene	51	50
the third	12	45	the tenth	36	24	ſeuenteene	54	30
the fourth	16	25	the tenth	39	0	eighteene	56	30
the fift	20	30	twelfth	41	20	nineteene	58	20
the ſixt	24	15	thirteene	43	15	twentie	61	10
the ſeuenth	27	30	fourteene	45	24	the xxj.	63	16

CHAP. XVIII.

Of Climes both old and new.

WHat is a Clime?

A Clime is a ſpace of the Earth comprehended betwixt two Parallels, in which ſpace the longeſt day doth vary by halfe an houre.

How many Climes be there?

The ancient Coſmographers diuided as well that part of the earth which lyeth betwixt the Equinoctiall and the North Pole, ſo much I ſay as they thought to be habitable, as alſo the habitable part which lyeth betwixt the Equinoctiall and the South pole, each of them into ſeuen Climes; to euery of which Northerne Climes they gaue a ſeuerall proper name, according to the name of the place through which the middeſt of the ſaid Clime did paſſe, for they called the firſt Clime Diameroes, Dia is a Greeke Prepoſition ſignifying in Engliſh, By or Through, and Meroes is a City of Egypt ſituated in a certaine Ile encloſed with the floud Nilus, which Ile hath alſo the like name. The ſecond Clime is called Dia Sienes, which is alſo a Citie in Egypt ſituated right vnder the Tropique of Cancer. The third Clime is called Dia Alexandrias, which is another Citie of Egypt ſituated vpon the Weſt mouth of Nilus, falling

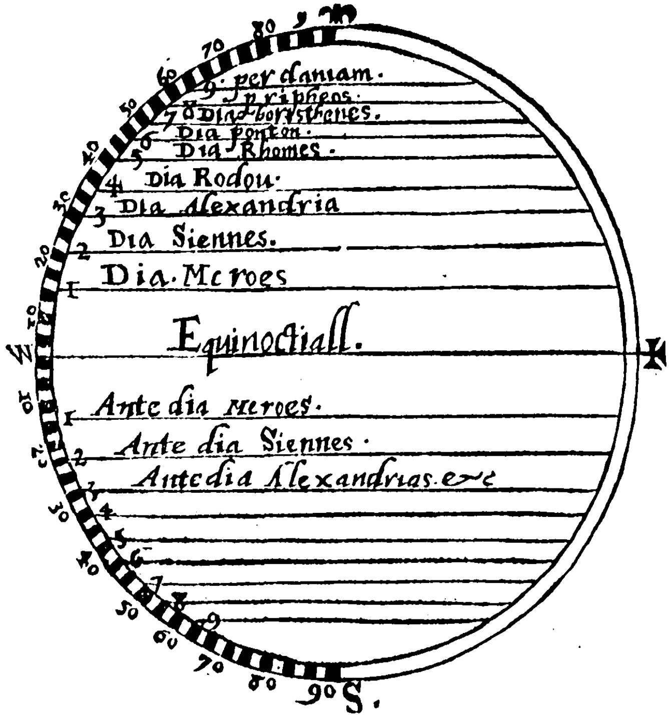
into

into the ſea of Egypt. The fourth Clime is called Dia Rhodon: Rhodos is the chiefeſt City of an Ile called Rhodos, ſtanding in the Sea called Mare Carpathium, waſhing the South weſt end of Natolia, ſometime called Aſia minor, which Iland together with the Citie Rhodos, Soliman the great Turke wanne not many yeares ſince from the Chriſtians. The people of this Ile in Saint Pauls time were called Coloſſians, to whom hee wrote one Epiſtle, and they were ſo called of a great brazen Image called in Latine Coloſſus, contayniug in Altitude 105. feet, which was dedicated to the Sunne, or, as ſome ſay, to Iupiter. The fifth Clime is called Dia Rhomes, that is to ſay, by Rome that famous City of Italy, and ſometime head of all the World. The ſixth is called of the old men Dia Boriſthenes, notwithſtandiug the moderne Writers thinke that it may be more rightly called Dia Ponton: Pontus is both a Sea & Countrey lying Eaſtward right againſt Conſtantinople. The ſeuenth Clime is called of the old men Dia Rhipheos, but of the moderne Writers Dia Boriſthenes, which is a great floud of Scithia, in the South part of Sarmatia, which falleth into the Sea called Mare Euxinum. To theſe ſeuen Climes, Appian addeth two others, ſo as in all he ſetteth downe nine Climes, making the eight Clime to paſſe thorow Ripheos, which are Mountains enuironing Sarmatia, on the North ſide; and the ninth through Denmarke.

What names did they giue to the Southerne Climes?

The ſelfe-ſame that the Northerne Climes haue, ſauing that they put before euery ſuch name this Greeke word Anti, which is as much to ſay as contrary or right againſt, as Anti-Meroes Anti-Syenes, &c. as you may eaſily perceiue by this figure of Climes heere following, notwithſtanding none of theſe Southerne Climes were knowne to Ptolomie more then Anti-Meroes, and hardly all that, the furtheſt part whereof hath not twentie degrees of Latitude.

And



And note that euery ſuch Clime is diuided into thrée parts, that is, the beginning, the midſt, and the end. And if you would know what degrées and minutes of Latitude euery ſuch part hath, that is to ſay, how many degrées euery ſuch part is diſtant from the Equinoctiall, then conſider well this Table following, which both briefly and plainly ſheweth the ſame.

	The beginning.		*The miaſt.*		*The end.*	
Degrees and minutes of Latitude.	D.	M.	D.	M.	D.	M
The firſt Clime.	12	45	16	35	20	30
The ſecond Clime.	20	30	24	15	27	30
The third Clime.	27	30	30	45	33	40
The fourth Clime.	33	40	36	24	39	0
The fift Clime.	39	0	41	20	43	30
The ſixth Clime.	43	30	45	24	47	15
The ſeuenth Clime.	47	15	48	40	50	30
The eighth Clime.	50	30	51	50	53	10
The ninth Clime.	53	10	55	30	56	30

May not the North and South part of the World each of them be diuided into more then nine Climes?

Yes indéed as our latter Writers affirme: for betwixt the Equinoctiall and the 66. degrée and 3′0. of Latitude, in which the longeſt day containeth full foure and twentie houres without hauing any night, they make 48. Parallels, and thereby foure and twentie Climes, for euery Clime contayneth two Parallels, and euery Parallel maketh the day to increaſe by one quarter of an houre, as hath beene ſaid before. But from thence-forth, though you may continue the Parallels almoſt to the very Pole, yet you can make no more but foure and twentie Climes, by reaſon that the ſpaces of the Parallels towards either of the Poles, doe grow more narrow euerie one then other, ſo as from 66. degrées and thirtie minutes of Latitude, vnder which the circle Arctique paſſeth, the longeſt day is not to be counted any more by houres, but by whole dayes, weekes, and monethes, in ſo much as they which dwell right vnder the North Pole, whoſe Zenith is the Pole it ſelfe, haue ſix moneths day whileſt the Sun abideth in the ſix Northerne ſignes, and ſix moneths night, the Sunne being in the ſix Southerne ſignes. And contrariwiſe, they that dwell right vnder the South Pole haue ſix moneth day, the Sunne being in the ſix Southerne ſignes, and ſix moneths night whileſt the Sunne remaineth in the ſix Northerne ſignes. But becauſe I thinke it a more ready way to account the length of the day by the degrées of Latitude, then by Climes or Parallels, I thought good here to ſet downe Orontius his Table made for that purpoſe, which from the 67. degrées of Latitude to the North Pole agréeth in all points with the Table of Iohannes de ſacro Buſto, in which Table from the ſaid 67. degrée, is not only ſet downe the longeſt day, but alſo what portion of the Zodiaque alwayes appeareth about the Horizon, which portion when it contayneth one whole ſigne, then the day is one moneth long, and the night as much, if two ſignes, then the day is two moneths long, and the night as much, and ſo forth ſucceſſiuely vntill you come to ſixe ſignes, which is the one halfe of the Zodiaque, making both day and night each of them ſixe monethes long, as I haue ſaid before, and as you may plainly ſée with your eye by placing the Spheare on his Horizon at euery ſuch Latitude.

A Table ſhewing the longeſt day in euery degree of Latitude, proceeding orderly from the Equinoctial to the North Pole, by whole degrees without minutes from one degree to ninety

Degrees of Latitude.		The longeſt day.		
D.	M.	H.	M.	S.
1	0	12	3	28
2	0	12	6	56
3	0	12	10	24
4	0	12	14	0
5		12	17	28
6		12	20	56
7		12	24	48
8		12	28	0
9		12	32	36
10		12	35	12
11		12	38	48
12		12	42	44
13		12	46	8
14		12	49	44
15		12	53	28
16		12	57	20
17		13	1	4
18		13	4	46
19		13	8	56
20		13	12	48
21		13	16	48
22		13	21	4
23		13	25	4
24		13	29	20
25		13	33	35
26		13	38	0
27		13	42	24
28		13	46	16
29		13	51	36
30		13	56	16
31		14	1	12
32		14	6	8
33		14	11	12
34	0	14	16	24
35	0	14	21	5
36	0	14	27	20
37	0	14	33	4
38		14	37	3
39		14	44	5
40		14	51	12
41		14	57	44
42		15	4	24
43		15	11	20
44		15	18	40
45		15	26	8
46		15	34	8
47		15	42	24
48		15	51	4
49		16	0	8
50		16	9	44
51		16	19	52
52		16	30	52
53		16	41	52
54		16	54	8
55		17	7	4
56		17	21	4
57		17	36	16
58		17	52	48
59		18	10	48
60		18	30	56
61		18	53	20
62		19	18	24
63		19	48	40
64		20	24	24
65		21	10	32
66		22	20	40

titude, proceeding orderly from the Equinoctiall to the degree to 90.

Degrees of Latitude.		The longeſt day.				The arch of the Zodiaque alway appearing aboue the Horizon.	
D.	M.	Dayes.	H.	M.		De.	M.
67	0	24	1	40		22	52
68	0	42	1	16		40	0
69	0	54	16	25		52	0
70	0	64	13	46		61	26
71		74	0	0		70	26
72		82	6	36		78	22
73		89	4	58		84	56
74		96	17	0		92	12
75		104	1	4		96	20
76		110	7	27		105	16
77		116	14	22		111	20
78		122	17	6		117	6
79		127	9	55		122	46
80		134	4	58		128	22
81		139	31	36		133	50
82		145	6	43		139	6
83		151	2	6		144	22
84		156	3	3		149	36
85		161	5	23		154	42
86		166	11	23		159	50
87		171	21	47		164	52
88		176	5	29		169	58
89		11	21	58		174	58
90		187	6	39		180	0

What things elſe doe the Coſmographers teach to be conſidered in Climes and Parallels ?

Diuerſe things, as firſt how many Italian **miles euerie Clime hath in breadth and length, and alſo what ſeaſons of the yeare,**

yeare, and what ſhadowes the Sun yéeldeth to thoſe that dwell vnder diuers Climes and Parallels.

What bredth and length doe the ancient Writers appoint to euery one of the ſeuen Climes.

They appoint ſuch bredth and length as this Table following ſheweth, in which alſo is ſet downe the degrees and minutes of Latitude, through which the Midle Parallel of euery Clime paſſeth, and alſo the number of miles anſwerable to one degrée of euery ſuch Latitude.

Climes.	Miles in bredth.	Miles in length.	The degrees and minutes of the Latitude, through which the middle Parallel of euery Clime paſſeth.		The number of Miles anſwerable to one degree of euery ſuch Latitude
			Deg.	M.	
1	465	20555	16.	37.	57
2	420	19453	24	15	54
3	370	18398	30	45	51
4	350	17299	36	24	48
5	270	16215	41	20	45
6	225	15136	45	24	42
7	195	14426	48	40	40

How is the bredth and length of euery Clime to be knowne?

The bredth is to be knowne by multiplying the degrées of difference contayned betwixt the beginning and end of euery Clime by 60. miles: And if the degrées of difference haue any minutes annexed thereunto, then you muſt adde ſo many miles as there be minutes, to the product of the former multiplication. Now to haue the length of euery Clime, you muſt ſeeke to know by the Tables of miles, how many miles bee anſwerable to one degrée of that Parallel of Latitude, which paſſeth through the midſt of the Clime, and by that number of miles multiply 360. and the product thereof ſhall be the length. But if the degrée of that Latitude haue any minutes annexed thereunto, then you muſt finde out the miles of thoſe minutes by the rule of proportion, in ſaying thus: if 60. doe require ſo

many

many miles, as you found in the Table of miles, what ſhall ſo many minutes require, and adde the quotient thereof to the product of the former multiplication, ſo ſhall you haue the true length of the Clime, all which things are obſerued in the foreſaid Table, which Table by obſeruing like order, you may extend (if you will) to the number of 24. Climes ſet down by Orontius and by diuers other moderne Writers.

Chap. XIX.

Of the diuers ſeaſons and ſhaddowes incident to diuers Climes and Parallels, and firſt what ſeaſons and ſhadow they haue that dwell right vnder the Equinoctiall.

Thoſe that dwell right vnder the firſt Clime and eſpecially right vnder the Equinoctiall, which people at one inſtant may ſée both the Poles, haue two Summers, and two Winters, for the Sunne hauing to paſſe right ouer their heads twice in the yeare, which is when hee is in Aries, and againe in Libra, then they muſt néedes haue two Summers, becauſe the Sunne at both thoſe times is higheſt vnto them, but when he is in Cancer or in Capricorne, then hée is furtheſt from them, and thereby maketh vnto them two Winters. But yet neither of them ſo cold as our Winter is, whereby it appeareth that our two times of Spring and Autumne, are to them two Sommers, and our two times of Summer and Winter are to them two Winters.

What ſhadowes haue thoſe Inhabitants?

They haue fiue ſundry ſhadowes, for when the Sunne is in either of the Equinoxes, they caſt their ſhadow in the morning when the Sunne riſeth towards the Weſt. And at night when he goeth downe towards the Eaſt, and at noone day they haue no ſhadow at all, but a perpendicular ſhadow, which ſtréeketh right downe from head to foot, becauſe the Sunne being then in the Equinoctiall muſt néedes at that time of the

day

day be right ouer their heads, as you may plainly ſee in euery materiall Spheare, hauing a foot with a firme Horizon, and duely placed to ſhew a right Spheare: but when the Sunne is in any place of the Southerne ſignes, then the foreſaid Inhabitants doe caſt their ſhadow towards the North. And when hee is in the Northerne ſignes, they caſt their ſhadow towards the South, and becauſe they dwell in a right Spheare, their dayes and nights be alwayes equall.

CHAP. X.

Of the ſeaſons and ſhadowes which they haue that dwell betwixt the Equinoctiall and Tropique of Cancer.

These haue alſo two Summers & two Winters and fiue ſhadowes like vnto the others, becauſe the Sunne paſſeth twice in the yeare right ouer their heads, firſt in his declining from the Equinoctiall, towards Cancer, and againe in his returning from Cancer towards the Equinoctiall, vnder which Clime Arabia fœlix is ſaid to bee ſituated. For Lucan writeth that the Arabians comming to Rome to aid Pompey, maruelled much to ſee that the Trees did neuer caſt their ſhadowes on the left hand, becauſe in their Country their ſhadow is ſometime on the right hand, and ſometime on the left, ſometime perpendicular, ſometime orientall, and ſomtime occidentall, but in Rome and in all other places beyond the Tropique of Cancer the ſhadow alwayes at noontyde tendeth Northward: the words of Lucan be thus, Ignotum vobis Arabes veniſtis in orbem, Vmbras mirati nemorum non ire ſiniſtras.

How is *Lucan* to bee vnderſtood herein vſing this ſpeech on the left hand?

As all other Poets are, for they hauing regard to the Weſt doe alwayes make the North part their right hand, and the South part the left. But the Aſtronomers hauing regard to the South, doe make the Weſt their right hand, and the Eaſt

their left hand: againe the Geographers contrariwiſe hauing regard to the North, doe make the Eaſt their right, and the Weſt their left hand. Whereby you may ſee that the right and left hand may be taken three manner of wayes, that is according to the manner of the Poets, of the Aſtronomers, and of the Geographers.

Sith theſe Inhabitants haue ſeaſons and ſhaddowes, like to thoſe that dwell right vnder the Equinoctiall, wherein then do they differ?

They differ in that their dayes and nights bee not alwayes equall, by reaſon that their Horizon declineth from the Poles of the World. And by cutting the Parallels of the Sunne with oblique Angles, it diuideth thoſe Parallels into vnequal parts, neither can their two Summers be ſo extreamely hot as the others, becauſe the Sunne for the moſt part is further from them.

CHAP. XXI.

Of the ſeaſons and ſhadowes which they haue that dwell right vnder the Tropique of Cancer.

They haue but one Summer and one Winter, by reaſon that the Sunne neuer paſſeth right ouer their heads but once in the yeare, and that is when hee entreth into the firſt degree of Cancer: In which time when the Sunne riſeth, the ſhadow tendeth towards the Weſt, and at noone the ſhadow is perpendicular inclining on neither ſide, but falling right downe. And at night when the Sunne goeth downe, the ſhadow tendeth towards the Eaſt: and at all other times of the yeare, the ſhadow at noonetyde falleth alwayes Northward, and as touching their dayes and nights, they ſhorten and lengthen according as the Sunne either approcheth towards Cancer, or retyreth towards Capricorne.

CHAP. XXII.

Of the ſeaſons and ſhaddowes which they haue that dwell betwixt the Tropique of Cancer, *and the Circle Arctique.*

They haue alſo one Summer and one Winter as we haue heere in England, for the Sunne neuer paſſeth right ouer their heads, by reaſon that ſo ſoone as he hath made his laſt and higheſt Parallel in Cancer, hee returneth againe Southward, and therefore their ſhaddow is neuer at noonetide perpendicular, but ſhooteth Northward, and the dayes and nights doe lengthen and ſhorten according as the Sunne maketh his courſe, either through the Northerne or Southerne ſignes. For whileſt hee paſſeth through the Northerne ſignes, the dayes are longer then the nights, and in paſſing through the Southerne ſignes, hee maketh the nights longer then the dayes.

CHAP. XXIII.

Of the ſeaſons and ſhaddowes which they haue that dwell right vnder the Circle Arctique, and how long their day is.

They haue but one Winter and one Summer, and their ſhaddow alwayes tendeth ſide-long and Northward. And becauſe their Zenith being in the Circle Arctique, is at all times of the yeare all one with the Pole of the Zodiaque: the Ecliptique Line therefore muſt needes bee all one with their Horizon, whereby the one halfe of the Zodiaque, in a very moment doth riſe aboue the Horizon, and the other halfe in the ſame inſtant goeth downe. And as the whole Tropique of Cancer appeareth alwayes aboue the Horizon: ſo the whole Tropique of Capricorne is alwayes hidden vnder the Horizon. So as when the Sunne entreth into the firſt degree of Cancer, their day is 24. houres long, and their night but a moment: ſo contrariwiſe when the Sunne entereth into the firſt degree of Capricorne, their night is twentie foure houres long, and their day but a moment, as you may plainly ſee by placing the Spheare at the 66. degree, and 30 of Latitude.

CHAP. XXIIII.

What ſeaſons, ſhaddowes, and length of day, they haue that dwell betwixt the Circle Arctique, and the Pole Arctique.

These haue like ſeaſons and ſhaddowes as thoſe that dwell vnder the Circle Arctique, ſauing that their Winter is colder and longer, becauſe the nigher thy approch to the Pole, the further are they from the Sunne, and alſo haue both longer dayes and nights, for the more that the Pole is eleuated aboue the Horizon, the greater portion of the Zodiaque doth alwayes appeare aboue the ſame: which portion if it contayne one whole ſigne, then their day is a moneth long, and their night as much, if two whole ſignes, then their day is two moneths long, and their night as much, and ſo forth as hath beene ſaid before.

CHAP. XXV.

Of thoſe that dwell right vnder the Pole.

WHat ſeaſons, ſhadowes, and length of day haue they that dwell right vnder the Pole, if there be any ſuch people?

Truly you doe well to doubt thereof, for in mine opinion, humane nature is not able to ſuffer the extreme cold, that by reaſon muſt needs be in thoſe parts, neither doe I thinke, that euer any man either Chriſtian or Heathen, did euer ſayle ſo farre as to diſcouer any Land there. Notwithſtanding, if there be any ſuch people, their ſeaſon is alwayes ſo extreame cold, as no part thereof is worthy to bee called a Summer, but rather a continuall Winter, and as for their ſhadow ſith the Sunne when hee is at the higheſt, doth neuer mount aboue their Horizon more then 23. degrees 3'0. at the moſt, their ſhadow muſt needs goe round about them, nigher for the moſt part to their feet then to their heads, for the Pole is their Zenith, & the Equinoctiall their Horizon, whereby ſixe ſignes which is the one halfe of the Zodiaque, doth alwayes appeare aboue their Horizon, and the other halfe is alwayes hidden vnder their Horizon, and thereby they haue ſixe moneths day, & ſixe moneths night, day I ſay whileſt the Sun is in the ſixe Northerne ſignes, and night, whileſt the Sunne is in the ſix Southerne ſignes, and yet the night cannot be ſo dark there as elſe where, by reaſon that the Sunne is neuer diſtant from their Horizon aboue 23. degrees 3'0. which is only when he entreth into the firſt degree of Capricorne. So likewiſe the day with them can neuer be ſo cleare as elſe where, by reaſon that the Sunne mounting no higher aboue their Horizon then 23. degrees 3'0. which onely is when hee entreth into the firſt degree of Cancer, hath no power to diſſolue their groſſe, thick, cloudie, & miſtie aire, yet haue they ſome preeminencie in that they may (if their cloudy aire be not the let) alwayes ſee all the fixed ſtars that are placed in the ſkie betwixt the Equinoctiall and the Pole, becauſe they neuer goe downe but are alwayes remaining aboue their Horizon: whereas in all other parts of the World, the ſaid ſtarres cannot be ſeene all at once, for that they both riſe and ſet, more or leſſe, in number according as the Zenith of the Inhabitans of euery place, is more or leſſe diſtant from the Equinoctiall.

CHAP. XXVI.

By what names certaine Inhabitants of the Earth are called as well according to the diuerſitie or likeneſſe of ſhaddowes, as of ſituation.

YOu ſhall vnderſtand that according to the diuerſitie or likeneſſe of ſhaddowes, the ancient Coſmographers haue giuen to the Inhabitants certaine Greeke names, whereof ſome are called Amphiſcij, ſome Heteroſcij, and ſome Periſcij.

Shew what theſe names doe ſignifie?

Amphiſcij, bee thoſe that caſt their ſhadowes both wayes, that is ſometimes towards the North, and ſometime towards the South, as thoſe that inhabit the burnt Zone.

Heteroſcij, bee thoſe that caſt their ſhadow onely one way, as thoſe that dwell in either of the temperate Zones, for if they dwell in the North temperate Zone, they doe caſt their ſhadow alwayes at noontyde towards the North. And if they dwell in the South temperate Zone, they caſt their ſhaddow at noontyde towards the South.

Periſcij, are thoſe that caſt their ſhadow round about them, as thoſe that dwell in either of the cold Zones, to whom the Pole is their Zenith: Againe, they giue them certaine names according to the diuerſitie or likeneſſe of their ſituation, and of the Seaſons incident to thoſe places, whereof ſome are called Antœci, ſome Periœci, and ſome Antipodes, ſiue Antichtones.

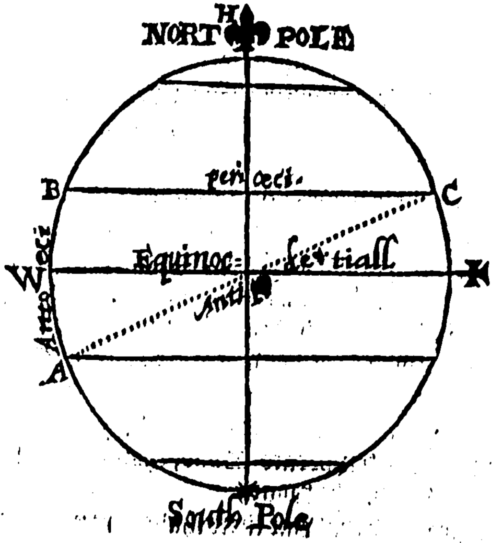
What doe theſe names ſignifie?

Antœci be two ſundry Nations, the one dwelling towards the

the North Pole, and the other towards the South Pole, hauing one ſelfe Meridian, and one ſelfe Latitude, that is to ſay, be of like diſtance from the Equinoctiall, the one Southward, and the other Northward, as the Letters A. B. in the Figure following doe ſhew.

Periœci be thoſe that dwell in one ſelfe Parallel, how diſtant ſoeuer they be Eaſt and Weſt, as the Letters B.C. in the ſaid Figure doe ſhew.

Antipodes be thoſe that dwell féet to féet, ſo as a right Line, being drawne from the one to the other, paſſeth through the Center of the World, as you may ſée by the Letters A. C. in the Figure following.



And the firſt of theſe called Antœci haue contrary ſeaſons of the yeare, for when it is Summer to the one, it is Winter to the other: Againe Periœci, though they haue like Seaſons of the Yeare, yet becauſe they are ſo farre diſtant in length one from another, it is therefore mid-day to the one when it is mid-night to the other. But Antipodes be contrary in Seaſons and in all other things, hauing nothing common, more then that they haue one ſelfe Horizon.

CHAP. XXVII.

By what names certaine parts of the Earth are called by reaſon of their diuers ſhapes.

NOw beſides the foreſaid names attributed to the Inhabitants of the Earth, for ſuch reſpect as is aboue ſaid, the Coſmagraphers doe giue alſo to diuers parts of the Earth according to the diuers ſhapes thereof diuers names alſo: for if any part of the earth be enuironed round with water eyther ſalt or freſh, it is called Inſula, that is an Iland, as England, Ireland, and ſuch like, but if the water goe round about it ſauing in one part, then it is called Peninſula, that is to ſay, almoſt an Iland, as Denmarke, Italie, Moria, and ſuch like, and if it bee a narrow ſtraight incloſed with the Sea on both ſides, then it is called Iſthmus, as the narrow ſtraight of Corinth lying betwixt Boetia and Achaia, in Greece which diuers Emperours of Rome haue in vaine attempted to cut, to the intent to make there through a Nauigable paſſage: finally, when it is neyther Inſula, Peninſula, nor Iſthmus: then it is called Continens, that is to ſay, firme land, as Saxonie, Boemia, Sueuia, and ſuch like, but theſe bee ſpeciall Continents, for the Coſmographers of theſe dayes doe make but thrée generall Continents, that is firſt ſo much as was knowne to Ptolomie, and to the reſt of the ancient Writers, ſecondly, the Weſt Indies lately found out, & thirdly, the South part of the World not yet wholly diſcouered: Againe the ancient men deuided that portion of the World, which was knowne in their dayes into thrée parts, that is, Europe, Aſia, and Afrique, whereunto the moderne Writers haue added a fourth part called America, contayning the Weſt Indies. Now if you would know what Kingdomes, Regions, Cities, Townes, Seas, with their Hauens, Ports, Bayes, and Capes, Iles, Flouds, Mariſhes, and Mountaines, are contayned in euery one of theſe foure parts, then peruſe often the vniuerſall Mappes, and Terreſtriall Globes, as well of the moderne, as of the ancient Writers, and alſo the Tables of Ptolomie, and of Ortelius, which I wiſh that they had beene made in ſuch forme as the Tables of Ptolomie are: for hauing the North alwayes ſet in the front, it ſhould bee the readier to compare the ſhape or ſituation of any place or Region to the vniuerſall Mappe, and by knowing the Longitude and Latitude of any place, it ſhould bee the eaſier to finde the ſame, as well in the ſpeciall Tables as in the vniuerſall Mappe or Globe. The vſe of which vniuerſall Mappes, I haue alreadie written in a ſeuerall Treatiſe by it ſelfe, printed not long ſince. But now for ſo much as the knowledge of the Windes hath beene alwayes thought a thing meete to bee treated of, by him that writeth of Coſmographie, and ſpecially of the Spheare, I will heere ſpeake ſomewhat of them, neyther doe I minde to make any great Diſcourſe thereof, as naturall Philoſophers are wont to doe, but onely to define what the Winde is, and to ſhew into how many parts the ſame is diuided, as well by the ancient as moderne Writers, and by what names they are called, and ſomewhat of the qualities thereof.

CHAP. XXIX.

Of the Winde, what it is, what motion it hath, and of the diuers names and diuiſions thereof.

FIrſt, then you haue to vnderſtand, that Ariſtotle and the reſt of his Sect, doe define the Winde to bee an exhalation hot and drie, engendred in the bowels of the Earth, and being gotten out, is carried ſide-long vpon the face of the Earth.

Why

Why is not his motion right vp and downe, as well as ſide-long?

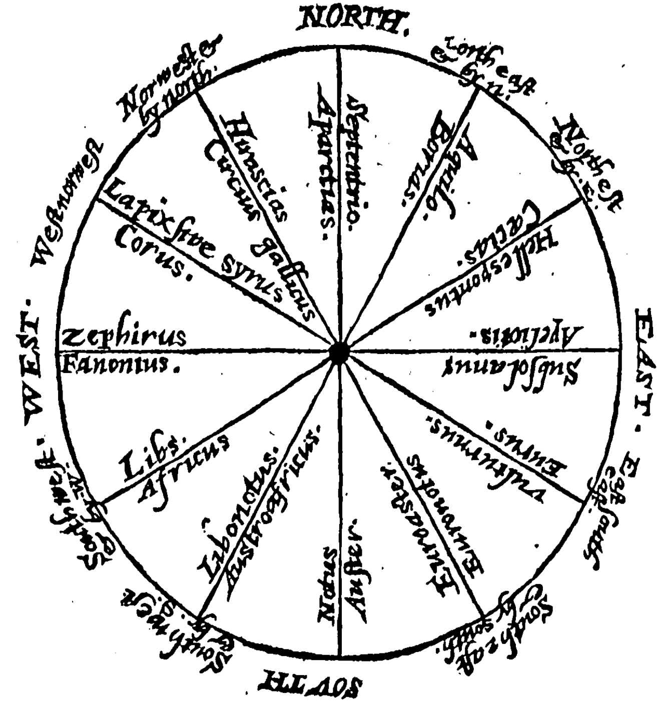
Becauſe that whileſt by his heate hee ſtriueth to mount vp, and to paſſe through all the three Regions of the Ayre, the middle Region by his extreme cold, doth alwayes beate him backe, ſo as by ſuch ſtrife, and by the meeting of other exhalations riſing out of the Earth, his motion is forced to be rather round then right.

What is the cauſe why hee bloweth more ſharpely at one time then another, and in one place more then another, and ſometime not at all?

As the fumes that riſe of new exhalations, and out of flouds and waters, may increaſe his force, ſo lacke of heate and fumes doe diminiſh the ſame. Againe, the roundneſſe of the Earth is cauſe that he bloweth ſometime more in one place then in another: alſo Mountaines, Hilles, and great Woods may hinder his force in ſome place of the earth, whereas vpon the plaine, or vpon the broad Sea hee bloweth moſt ſharpely, and as for his not blowing at all, it may chance diuers wayes, as either for lacke of ſufficient heate to open the pores of the Earth to let himſelfe out, or for that ſome extreme froſt and cold doth cloſe the pores of the Earth ſo ſtraite that hee cannot get forth, or for that the Sunne with his extreme heate conſumeth the fumes and vapours that ſhould maintayne him. But leauing to anſweare any more to theſe Queſtions, I will ſhew you how many Windes were obſerued by Saylers in olde time, and how many are obſerued at this preſent day, and how they were named. True it is that all Nations doe agree in placing the foure principall Windes, according to the foure quarters of the Horizon or Angles of the World, that is to ſay, Eaſt, Weſt, North, and South: but in the ſubdiuiſion of the ſayd foure Quarters they differ, for ſome deuide euery Quarter of the Horizon into two, making onely eight Windes, and ſome into three, and thereby doe make twelue Windes, which the ancient Greekes and Romanes did chiefely obſerue. The names of the eight Windes are commonly expreſſed in the Italian Tongue thus: Thramontano, North,

Mezzodi

Mezzodi, South, Leuante, Eaſt, Ponente, Weſt, Griego, Northeaſt, Garbino, Southweſt, Maiſtro, Northweſt, Syroccho, Southeaſt, which names are often vſed by Chriſtopher Columbus, Albertus Veſputius, and others that ſayled firſt into the Eaſt and Weſt Indies: and if you will know the names of the twelue Windes vſed by the ancient Greekes and Romans, then behold this Figure héere following, wherein you ſhall find them ſet downe in Engliſh, Gréeke, and Latine, that is to ſay, the Engliſh names without the Circles, and the Gréeke and Latine names within the Circle, the Gréeke vpon the right ſide of euery Line pointing the Wind, and the Latine name vpon the left ſide of euery ſuch Line.



CHAP.

CHAP. XXIX.

Of the nature and qualities of the foreſaid twelue Windes.

THe North Winde called Septentrio, or Apractias, is extremely cold and drie, prohibiting Raine, it preſerueth health by cleanſing the Ayre of all peſtiferous infections, but it cauſeth dry colds, and hurteth the fruites and flowers of the Earth.

2 The Northeaſt and by North, called Aquilo or Boreas, is alſo cold and drie without raine, it hurteth the Flowers and Fruites of the Earth, and eſpecially the Vines when they budde.

3 The Northeaſt and by Eaſt, called Helleſpontus or Cæcias, is hot drying vp all things.

4 The Eaſt Winde called Sobſolanus, is hot and dry, temperate, ſwéete, pure, ſubtle, and healthfull, and ſpecially in the morning when the Sunne riſeth, by whom hee is made more pure and ſubtill, cauſing no infection to mans bodie.

5 The Eaſt Southeaſt, called Eurus or Vulturnus, is alſo hot and dry, hee bloweth lowde, and therefore is called of Lucretius, Altitonans, Vulturnus.

6 The Southeaſt and by South called Euroaſter or Euronotus, is hot and moyſt, and bréedeth Cloudes and ſickneſſe.

7 The South Winde called Auſter or Notus, is hot and moyſt, bréeding thicke Cloudes, great Raines, and peſtiferous Ayre.

8 The Southweſt and by South called Auſtro Aphricus, is temperately hot, and yet bréedeth ſickneſſe, and raine, as ſome write.

9 The Southweſt and by Weſt, named Aphricus or Libs, is cold and moyſt cauſing raine.

10 The

10 The Weſt Winde, called Fauonius, or Zephirus, is temperately hot and moyſt, and wholeſome in the Euening, it diſſolueth Froſt, Ice, and Snow, and maketh Flowres and Graſſe to ſpring, and ſome write that it cauſeth thunder.

11 The Weſt Northweſt, called Corus or Syrus, is cold and moyſt, without any great rigour.

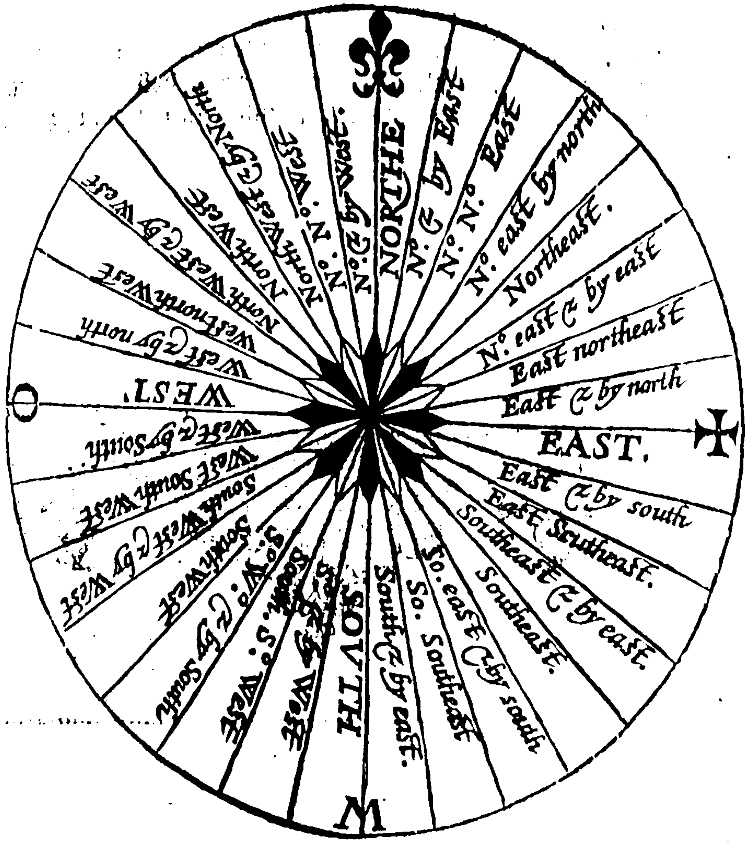
12 The Northweſt, and by North, called Syrus or Trachias, is colde and dry, of Earthly nature, breeding Snow and Windes.

CHAP. XX.

Of the moderne diuiſion of the Windes.

BUt the Marriners of theſe our latter dayes, to bee the better aſſured of their Routes and Courſes on the Sea, doe diuide euery quarter of the Horizon into eight ſeuerall Windes, ſo that they make in all two and thirty Winds, which of the Spaniards are called Rombes, which Windes together with their names, you may ſee plainly ſet forth in this Figure following, repreſenting the Marriners Compaſſe.

A Figure of the thirtie two Windes repreſenting the Marriners Compaſſe.



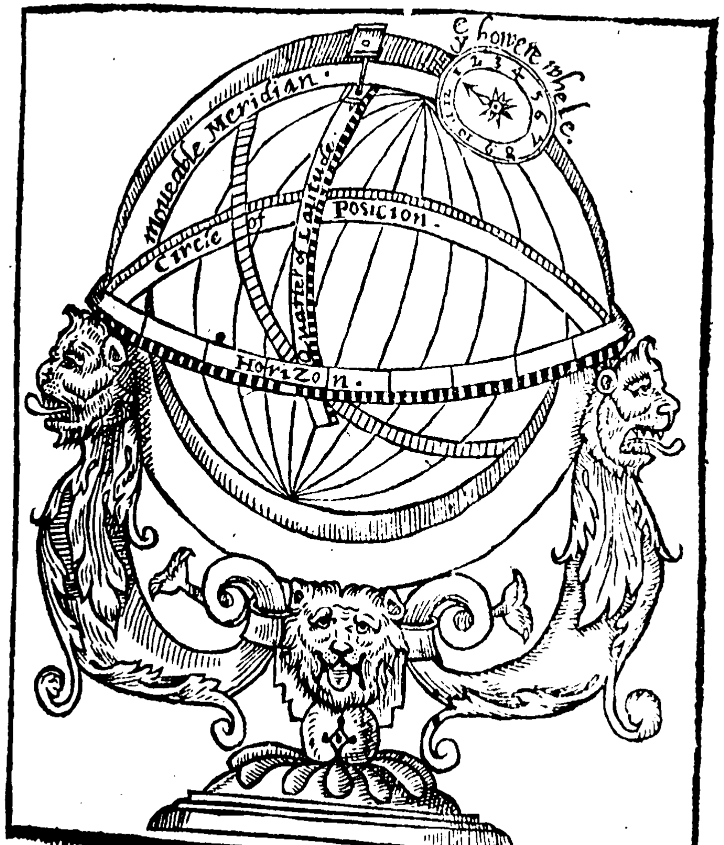
And note that eight of theſe Windes are called principall Windes, that is South, North, Eaſt, Weſt, Northeaſt, Southweſt, Northweſt, and Southeaſt, and all the reſt are called Collateral winds, but the firſt foure are chiefeſt, from whence the names of all the reſt are deriued, neither doe the learned Pilots in their Tables call the firſt foure winds, Rombes, but will ſay the firſt, ſecond or third Rombe from North, from Eaſt, South, or Weſt, vnto the number of ſeuen, for ſo many Rombes they make in euery quarter betwixt the foure chiefe and principall Winds, of which matter I ſhall ſpeake hereafter in my Treatiſe of Nauigation. In the meane time I heartily pray all thoſe that ſhall vouchſafe to read this my Treatiſe of the Spheare, to take my labour therein beſtowed in good part, and where any fault is, friendly to correct the ſame without any ſcorne or diſdaine.

A

A plaine deſcription of *Mercator* his two Globes, that is to ſay, of the Terreſtriall Globe *and of the Celeſtiall Globe, and of eyther of them,* Together with the moſt neceſſary vſes thereof written by M. *Blundeuill.*

Whereunto is added a briefe deſcription of the two
great Globes lately ſet forth by M. *Molinaxe:* and
of Sir *Francis Drake* his firſt Voyage
into the INDIES.

ZENITH.



Hee telleth the number of the Starres, and calleth them by their name. *Pſal.* 147.

Imprinted at *London* by *William Stansby.*

A plaine deſcription of the two Globes of Mercator, that is to ſay, of the Terreſtriall Globe *and of the Celeſtiall Globe, and of eyther of them,* Together with the moſt neceſſary vſes thereof, and firſt of the Terreſtriall Globe, written by M. *Blundeuile.*

THE Terreſtrial Globe is a round bodie, couered with an vniuerſall Mappe, containing both Sea and Land, which is diuided by the later Coſmographers into foure principall parts, that is, Europe, Affrique, Aſia, and America, the Longitude and Latitude of euerie which part, is already ſet downe in my deſcription of vniuerſall Mappes and Cards. And in this Globe are alſo ſet down certain ſtars, ſome towards either of the Poles, and ſome nigh to the Ecliptique line, whereof we ſhall ſpeake hereafter, when we come to treat of the Celeſtiall Globe. But you haue to vnderſtand, that the one end of this Globe is called the Pole Articque, that is to ſay, the North pole, and the other end the Pole Antarticque, that is to ſay, the South Pole: vpon which two Poles it is turned about. And this Globe is traced with certaine circular lines, whereof ſome be greater, and ſome leſſer: thoſe greater which paſſe through both the Poles, are called Meridians, of this word Meridies, which is as much to ſay, as noone-tide: for when the Sunne toucheth any of thoſe Circles, it is noone-tide to all thoſe that dwell right vnder that Circle, of which Meridians, though you may imagine to bee halfe ſo manie as there bée degrees in the Equinoctiall, which amounteth to the number of 180, yet there are ſet downe in this Globe, no more but twelue, which doe cut the Equinoctiall in 24 points, making thereby 24. ſpaces, euerie ſpace contayning 15. Degrées of the Equinoctiall, which 15. Degrees doe make one houre, for the Equinoctiall is a great Circle, which guirding the Globe in the verie middeſt betwixt the two Poles, and repreſenting the motion of the firſt mooueable, maketh his dayly reuolution from Eaſt to Weſt, in foure and twenty houres. And this great Circle by diuiding the Globe into two equall parts, cauſeth the ſame to haue two Latitudes or bredthes, the one Northerne, and the other Southerne, for that ſpace of the halfe Globe which lyeth betwixt the Equinoctiall and the South Pole, is called the North Latitude, and the other halfe of the Globe which lyeth betwixt the Equinoctiall and the South Pole, is called the South Latitude, each Latitude containing euery where from the Equinoctiall to either of the Poles ninetie Degrees. Againe, this Circle is diuided into 360. Degrees, containing the whole Longitude of the Earth, and euerie Degree is 60. Italian miles, which béeing multiplyed into 360. maketh in all 1600. miles, and ſuch Longitude is to bee counted from Weſt to Eaſt, beginning the ſame at the firſt Meridian, which paſſeth thorough the Iles of Canaria, otherwiſe called Inſulæ Fortunatæ, croſſing the Equinoctiall and the Ecliptique Line, in the firſt Degrée of Aries, and alſo in the firſt Degrée of Libra, which are the two Equinoctiall points, ſo as the one halfe of the Equinoctial which goeth from Weſt to Eaſt, containeth 180. Degrées, and the other halfe returning againe from Eaſt to Weſt, contayneth alſo 180. Degrées, which maketh in all 360. Degrées, ending where the firſt Degrée of Longitude did beginne: For though Mercator, and others, in their ſeuerall Mappes doe in theſe dayes make the firſt Meridian to paſſe through the Iles Azores, which are fiue Degrées more to the Weſt: Yet Mercator in his great terreſtrial Globe dedicated firſt to the Lord Granuella, and afterwards to the Emperour Charles the fift, Anno Domini, 1541. placeth the firſt Meridian as before is ſaid,

both whoſe Globes my Worſhipfull Friend Sir Thomas Knyuet of Aſhwelthorpe Knight, did courteouſly lend mee I thanke him, who as hee is very well learned in all Liberall Sciences himſelfe, ſo he is a great fauourer and fartherer of all ſuch as delight in any learned or vertuous exerciſe: And by the helpe of thoſe Globes I wrote this Treatiſe. But to returne to my matter, there is another great ſtooping and ouerthwart Circle, called the Ecliptique line, vnder which the Sunne continually walketh, and this line is marked with the Characters of the twelue Signes, euery Signe containing in length, thirtie ſuch degrées as the Equinoctiall hath, ſo as in all, the Ecliptique line containeth thrée hundred ſixtie degrées, which is the Longitude of Heauen, and the firſt degrée of the Longitude of any Starre beginneth at the firſt point of Aries, and endeth at the ſame point.

Now of the leſſer Circles there bee foure principall, that is, the two Tropiques, that is to ſay, the Tropique of Cancer towardes the North Pole, and the Tropique of Capricorne towardes the South Pole, betwixt which two Tropiques, the Sunne continually goeth right vnder the foreſayde Ecliptique line, neuer mounting higher then the Tropique of Cancer, or deſcending lower then the Tropique of Capricorne. Of the other two leſſer Circles, the one is called the Circle Artique, enuironing the North Pole, and the other the Circle Antarctique enuironing the South Pole: all which foure Circles are called Parallels; that is to ſay, equally diſtant one from another, and by reaſon of theſe foure Circles, the Globe is diuided into fiue Zones, that is to ſay, two colde Zones, two temperate, and one extreamely hotte: Of the colde Zones, the one lyeth betwixt the Circle Antarctique, and the South Pole, and the other betwixt the Circle Arctique, and the North Pole.

And of the temperate Zones, the one lyeth betwixt the Tropique of Cancer, and the Circle Arctique, and the other lyeth betwixt the Tropique of Capricorne and the Circle Antarctique. The hotte Zone is that which lyeth betwixt the two Tropiques, through the middeſt of which Zone paſſeth the foreſaid Equinoctiall line, right vnder which, they that dwell haue no Latitude at all, and therefore their dayes and nights are alwaies equall, (that is to ſay) twelue houres day, and twelue houres night. Alſo beſides theſe foure foreſaide leſſer Circles or Parallels, the Globe is traced with eight other Paralell Circles, on the each ſide of the Equinoctiall towards either of the Poles, making on each ſide nine equal ſpaces, euery ſpace containing tenne degrées of the Equinoctiall, ſo as they do make in all 90. degrées, which is a quarter of the great Circle. Moreouer, there bée certaine Mariners Compaſſes, diuided into 32. circular lines, ſignifying the 32. winds, whereby the Mariners do ſaile, and doe direct their Shippes from Port to Port, which lines doe diuerſly croſſe the other Circles before rehearſed. Beſides, theſe Circular lines before deſcribed, there is faſtened vnto the two Poles of the Globe, a Meridian of Braſſe commonly called the moueable Meridian, within the which the Globe turneth about, and this Meridian is diuided into foure quarters, euerie quarter containing 90. degrées, ſo as the whole circuite thereof is 360 degrées, one of which quarters towards the North Pole is diuided with circular lines into thrée ſeuerall ſpaces, in the firſt and loweſt whereof, being next to the bodie of the Globe, are ſet downe the numbers of degrées of Latitude. In the next ſpace aboue that, are grauen the Paralells and numbers of houres of the longeſt day in euerie Latitude, and the ſpaces of euerie houre are diuided with little ſtrékes into foure parts, ſignifying the foure quarters of an houre: and theſe houres doe encreaſe till you come to 24. houres, and from thence the day increaſeth by moneths, from one to ſixe, ouer which is grauen this Latine word Menſes, (that is to ſay) monethes, and the third and vppermoſt ſpace containeth the Climes, beginning at one, and ſo procéede to eight. The like Climes, Parallels, and houres of the longeſt day are to be accounted alſo in the ſaid brazen Meridian, procéeding from the Equinoctiall towards the South Pole, though they bée not there ſet downe. And vpon this Brazen Meridian is placed at the North Pole

another

another little Brazen Circle, together with his Index called the houre wheele, euery halfe whereof containeth twelue houres, the Index of which Whéele being ſet vpon the North-Pole, turneth about as the Globe turneth, and yet you muſt imagine the Pole it ſelfe to be immoueable. Alſo there is a quarter Circle of thinne Braſſe plate, diuided into ninety degrées faſtned in ſuch ſort vpon the Brazen Meridian, as you may remoue it to and fro, yea, and alſo take it cleane off if you will, which quarter Circle hath a ſquare head of Braſſe, ſignifying the Zenith or Vniuerſall point of any place, and this Circle is called the quadrant of Altitude, which quadrant is diuided into ninety degrées, procéeding from the Horizon vpward to the Zenith, whereby may bee deſcribed vpon the Globe the ninety Almicanterathes or Circles of Altitude. And this quadrant ſerueth for diuers purpoſes, as to finde out thereby the Altitude of any Starre or point of the Ecliptique line, or of any other point in heauen, and the very edge thereof on the right hand, ſheweth the Azimuth or Verticall Circle of any place, and in what coaſt and part of heauen any Star is. Alſo, how any place of the earth beareth one from another as you ſhall more plainly perceiue héereafter by the examples of certaine propoſitions thereto belonging. Then there is another Circle of Braſſe-plate ſome-what thicker, called the Semi-Circle of poſition, which ſerueth chiefely for matters of Aſtronomie, as to find out the twelue Houſes of Heauen, and is to bee faſtned on the Horizon, ſo as it may be remoued and ſet vpon which ſide of the Globe you will. Alſo there belongeth to the Globe a litle round ſquire of Braſſe, made with right Sphericall Angles, the head or ſtile whereof is to ſhew the ſhadow of the Sunne being ſet vpon the Globe, inſtead whereof, a Néedle being ſet right vp, will ſometimes ſerue the turne. Finally to the Globe belongeth another Circle called the Horizon, which is a broad Circle of Wood, hauing a foote of wood, within which Horizon, the Globe together with the brazen Meridian, is to bee ſet at what Altitude you liſt. And this Horizon, is diuided with diuers circular lines into 7. vnequall ſpaces, whereof the firſt and narroweſt

ſpace

ſpace next vnto the bodie of the Globe, conteyneth the degrees of the 12. ſignes of the Zodiaque, euery ſigne conteyning 30. degrees. The ſecond ſpace conteyneth the Characters, and names of the ſaid ſignes, and alſo the number of the degrees, as 10. 20. 30. The third, the dayes of euery moneth. The fourth, the names of euery moneth, and of certaine Feſtiuall dayes. The fifth, the names of the twelue winds, which the ancient Greekes and Romanes were wont to obſerue, whereof I haue alreadie ſpoken in my Sphære. The ſixth and ſeuenth, doe ſhew the twelue houſes, together with their ſignifications neceſſary for the ſetting of Figures, and calculating of Natiuities, and in the foot of the ſaid Horizon is a little Compaſſe with a Needle to ſhew the North and South, according to which the Globe is to bee placed. But yet not before the ſaid Needle bee truly rectified, according to the variation which it hath in that place where you are to vſe the Globe: for otherwiſe the Needle may cauſe great errour, whereof we ſhall treate in the next Chapter. Thus hauing briefly deſcribed the Terreſtriall Globe, and all the parts thereof, I thinke it good now to ſhew you how to place the Globe according to the foure quarters of the world.

This Treatiſe of the two Globes contayneth fiftie PROPOSITIONS, as followeth.

HOW to place the Globe truly, according to the foure quarters of the World, and according to the Latitude of any Region. Propoſition. 1.

To know vnder what Clime any place or Region is, and how many houres the longeſt day is there, and alſo what Latitude any place deſcribed in the Map hath. Propoſition. 2.

How to know what Longitude any place deſcribed in the Map hath. Prop. 3.

How to know the diſtance betwixt any two places deſcribed in the Map. Prop. 4.

To know how one place beareth from another. Prop. 5.

How to find out by the Globe the place of the Sunne, that is to ſay, the degree and minute of that ſigne wherein the Sunne is euery day throughout the yeare. Prop. 6.

How to rectifie the Index of the houre-wheele, for euery ſeuerall day throughout the yeare. Prop. 7.

How to know euery day at what houre the Sunne riſeth or ſetteth. Prop. 8.

How to know in what part of the Horizon the Sunne riſeth and ſetteth euery day. Prop. 9.

How to know the length of euery day and night throughout the yeare, as well by helpe of the houre-wheele, as by counting the degrees vpon the Horizon. Prop. 10.

How to know by the Globe, how much the Sunne declineth euery day throughout the yeare from the Equinoctial. Prop. 11.

How

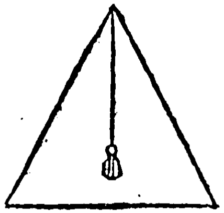
of

The vſe of the Globe.

PROPOSITION. I.

How to place the Globe truly according to the foure quarters of the world, and according to the Latitude of any Region.

First ſo fit your Globe together with the Brazen Meridian in the two nickes of the Horizon, & alſo in the ſlit of the Pin which ſtandeth in the midſt of the foote, ſo that the North pole of your Globe be anſwerable to the North quarter or North wind of the world, deſcribed vpon the Horizon, and ſee that that part of the Brazen Meridian, wherein are deſcribed the Climes, Parallels & houres of the longeſt day, may ſtand aboue the Horizon: & alſo that the one halfe of the brazen Meridian may iuſtly & euenly appeare aboue the Horizon, & the other halfe vnder the Horizon: Againe, you muſt ſee that the Equinoctiall line of the Globe do meet iuſt with the middle point or ſtreek of the brazen Meridian, whereas the firſt degree of Latitude doth begin, & alſo that the body of the Globe do not leane to the one ſide of the Horizon more than to the other, but to be equally diſtant from the ſame in all places, & in any wiſe to ſee that the Horizon ſtand alwayes leuell, to which end ſome Globes haue a plummet of Leade hanging by a little chaine or threed, which becauſe it will moue with euery wind, I for my part do thinke it better for you to haue ſuch a little leuell made of purpoſe, as you may ſet the ſame vpon any place of the Horizon where you liſt, and thereby make the



Horizon to ſtand leuell on euerie ſide as you will your ſelfe, and it may be made of a little peece of thicke boord, like a Triangle, as the former figure demonſtrateth.

Then with your two hands laying hold of the two next pillers, turne the foot of the Globe vntill it ſtand right North and South, which is to be done thus. Firſt finde out the true Meridian of the place whereas you are to vſe the Globe, by ſuch meanes as Maſter Burrough teacheth in his Diſcourſe of the variation of the Compaſſe, the 7. Chapter, which vndoubtedly is a moſt certaine way, by which you ſhall find three things at one inſtant, that is, the true Meridian, the variation of the Needle, and the true Latitude of any place. But if you haue not the inſtrument of variation, by helpe whereof this matter is to be accompliſhed, then in ſome open place betwixt eight and nine of the clocke in the fore noone or ſooner, vpon a ſmooth Table or Planke ſtanding leuell, draw a good large Circle with your Compaſſes, in the Center whereof muſt be fixed a round and ſtraight pinne of Iron or Latton wire, in length a good deale ſhorter then the Semidiameter of that Circle, and to the intent that the pinne or ſtile may ſtand right vp, without inclining on either ſide, it would bee rectified by a true Squire: That done, waite diligently vntill the ſhadow of the pin-head doe iuſtly touch the circumference of the Circle, ſo as it neyther paſſe beyond the Circle, nor come ſhort of the ſame, and there make a pricke, and ſo let it ſtay vntill about three of the clocke in the afternoone, about which time, the ſhadow of the pinne will beginne to approach nigh vnto the ſaide Circle, and ſo ſoone as it toucheth the ſame, make there another pricke: that done, deuide the Arch or portion of the Circle, contayned betwixt thoſe two prickes into two equall parts, and in the midſt thereof ſet another pricke, then laying your ruler to the middle pricke, and to the Center of the Circle, draw a right line through the Center, and alſo through the middle pricke, from the one ſide of the Circle to the other, and beyond if you liſt: for you may make the ſaid line of ſuch length as you ſhall thinke moſt meete to ſerue your turne, and that Line ſhall bee the true Meridian for that place, ſhewing the right North

and

and South part of your Horizon, and by croſſing the ſaid line with another right line in the verie midſt with right Angles, you ſhall haue the true Eaſt and Weſt, and to auoyde long waiting, you may draw diuers Circles one within another. Thus hauing found the true North and South, Eaſt & Weſt, place your Globe accordingly, ſo as the Brazen Meridian of the Globe may anſwere the Meridian line already drawn vpon the Boord or Planke, and to the intent that afterward you may know at all times both day and night, how to place your Globe right North and South, it ſhall be neceſſary to draw a right line vppon the foote of the Horizon, anſwerable to the foreſaid Meridian, firſt drawne vpon the boord or planke, and vpon that line to faſten a prettie handſome Compaſſe, hauing a Needle of an inch long at the leaſt, which is much more certaine, than ſuch a little Needle as is wont to be ſet in the foot of euery Globe. And when the needle ſtandeth ſtil, marke how much the North point thereof declineth eyther Eaſt or Weſt, from the true Meridian before taken, and whereas you ſee the Needle to decline, bee it Eaſt or Weſt, there ſet faſt a litle pin of Latton to ſerue as a marke, whereto you may alwaies direct the North point of the Needle, when you would haue the Globe to ſtand right North and South, for there is no Needle touched with the Load ſtone, be it neuer ſo good a ſtone, but it will varie from the true Meridian line, either more or leſſe, and therefore no truſt is to be giuen to the Needle vntill you know the true variation thereof, the finding of which variation, as I ſaide before, is moſt truly taught by M. Borough in his Booke before mentioned, whereunto I once againe referre you, & the rather for that it is written in our mother tongue. But Gemma Friſius teacheth to ſet the globe right North and South, thus, firſt goe into an open place whereas the Sunne ſhineth, and vpon ſome Table ſtanding leuell, and alſo the Globe ſtanding leuell, the Pole being eleuated aboue the Horizon according to your Latitude, fixe a ſtraight Needle in the degree of the ſigne, wherein the Sunne is that day, ſo as the Needle may ſtand right vp, without inclining any manner of way: and if it be in the forenoone, turne the Eaſt ſide of the

Globe

Globe towards the Sunne, mouing both the Globe and his ſeate to and fro, vntill you ſee the Needle to caſt no ſhadow at all, for ſo ſhall the Globe ſtand right North and South. But if it be in the afternoone, you muſt turne the Weſt ſide of the Globe towards the Sunne, and then worke as before, and by any of theſe wayes before taught, you ſhall not onely place the Globe anſwerable to the foure quarters of the world, but alſo you ſhall finde that the Circles, Poles, and Axeltrees of the Globe, are anſwerable to the Circles, Poles, and Axeltrees of the Heauens. Now hauing placed your Globe anſwerable to the foure quarters of the World, learne to know by ſome Table or moderne Mappe, or elſe by ſuch wayes as are ſet downe both in my Spheare, and alſo in the latter end of this Treatiſe, the Latitude of the Region wherein you dwell: As for example, the Latitude of theſe parts heere about Norwich, is 52. degrees, then taking hold of the brazen Meridian, as well with your left hand aboue the Horizon, as with your right hand beneath the Horizon, turne the ſame vp and downe in the nickes of the Horizon, vntill the North Pole bee eleuated aboue the Horizon 52. degrees, the laſt of which degrees muſt meete euen with the vpper brimme of the Horizon, that done, ſeeke for England in the Globe, not leauing to turne the body of the Globe to and fro, vntill you haue brought that Meridian which paſſeth through England, right vnder the brazen Meridian, and holding it ſtill at that ſtay, draw the head of the brazen quadrant of Altitude right ouer the place, and ouer that Meridian vnder which you dwell, ſo ſhall the head of your brazen quadrant ſtand for our Zenith in the verie midſt of the Horizon, and keeping all things thus at a ſtay, you may ſee how euerie Region or Countrey is ſituated, and how it beareth from you, and which be vnder your Climate, and which be not, and to be ſure that the brazen Zenith may ſtand in his right place, it ſhall be needfull to ſet it ſo as the left ſquare ſide thereof made with a long notch, may touch the ſelfe ſame degree of Latitude in the brazen Meridian, which it hath of Altitude: for looke how many degrees the Pole is eleuated aboue the Horizon, which is called the Altitude, ſo manie degrees muſt the brazen Zenith be diſtant from the Equinoctial of the Globe, which is called the Latitude, and is euer all one with the Altitude of the pole. Thus hauing ſhewed you how to place the Globe according to the foure quarters of the World, I thinke good now to declare vnto you, firſt the vſes of the terreſtriall Globe, whereof ſome are common alſo to the Celeſtiall Globe, as you ſhall perceiue heereafter by the propoſitions following, which propoſitions may be very wel diuided into three ſorts, whereof the firſt doe properly belong to the deſcription of the vniuerſall Mappe, wherewith the Terreſtriall Globe is couered, which are but few in number. The ſecond kinde of propoſitions do chiefely belong to the Sunne, and to his apparances, which are alſo common to the Celeſtiall Globe, and may bee found out by either of the Globes. But the third kind doe belong moſt properly to the fixed Stars, and to their apparances, and therefore I minde not to ſet them downe, vntill I come to deſcribe the Celeſtiall Globe, and to ſhew the vſes thereof.

The chiefeſt propoſitions belonging to the vniuerſall Map, wherewith the terreſtrial Globe is couerd, are theſe following.

PROPOSITION. II.

To know vnder what Clime any place or Region is, and of how many houres the longeſt day is there, and alſo what Latitude any place deſcribed in the Map hath.

Hauing ſet the Globe at yonr Latitude, bring the place or Region which you ſeeke right vnder the Brazen Meridian, and the vpper ſpace of the ſayde Meridian, will ſhew the Clime. And the ſecond or middle ſpace, will ſhew the houres of the longeſt day. And the third ſpace, the Latitude: As for example, if you would know vnder what Clime London is, then hauing found London, fix a long Needle in the red ſpot next to the name of London (for al towns for the moſt part in the Globe, are marked with red ſpots) that done, turne the Globe with your hand vntill the Néedle do touch the brazen Meridian, and by ſtaying the Globe there with your hand, you ſhall finde London to bee vnder the eight Clime, and that the longeſt day in the yeare is there 16 houres, and 20. minutes, and the third and nethermoſt ſpace doth ſhew the Latitude of the place which is 51. degrées, 32. Againe, by obſeruing this order without changing your Latitude, you ſhall finde Venice to be vnder the 6. Clime, and the longeſt day to be 15. houres and ſomewhat more, and the Latitude of that City to be 44. degrées, 3'0. and you ſhall finde Ieruſalem to be vnder the third Clime, & the longeſt day there to be 14. houres, and the Latitude thereof to be 31. degrées, 3'0.

PROPOSITION. III.

How to know what Longitude any place deſcribed in the Mappe hath.

THe Globe ſtanding ſtill at your owne Latitude, pricke the Néedle in the place whereof you ſéeke the Longitude, and bring it as before to the brazen Meridian, and ſtaying it there, lóoke at what number of degrées the brazen Meridian cutteth the Equinoctiall, and that is the Longitude of the place, counting the degrées from the firſt degrée of the Equinoctiall, which beginneth at the firſt point of Aries vnto the place of the ſection: by doing thus, you ſhall finde the longitude of London to be 19. degrées, and the Longitude of Venice to be 36. degrées, and the Longitude of Ieruſalem to be 67. degrées, and 30. minutes.

PROPOSITION. IIII.

How to know the diſtance betwixt any two places deſcribed in the Mappe.

OPen your Compaſſes ſo wide, that you may ſet the one foote thereof iuſt in the one place, and the other fóote in the other place, and apply that wideneſſe to the Equinoctiall line, counting how many degrées of Equinoctiall are contained betwixt the two féete of your Compaſſes, and by allowing to euerie degrée 60. miles, you ſhall haue the true diſtance of the places. Thus you ſhall find the diſtance betwixt London and Venice to be 13. degrées, 3'0. which being multiplied by 60. maketh 810. miles, and the diſtance betwixt London and Ieruſalem to be 40. degrees, 3'0. which being multiplied by 60. maketh 2430. miles. And it maketh no matter to what part ſoeuer the Equinoctiall, you doe apply the wideneſſe of your Compaſſes, ſo as you ſet the firſt fóot at the verie beginning of ſome one degrée, and let the other fóot fall out as it will, either at the whole degree, at a halfe, or at a quarter of a degree, which ſmall parts are to be counted by minutes, by coniecturall diſcention. And note héere, that no two places can bee diſtant one from another Eaſt & Weſt, more then 180. degrées, which is iuſt the one halfe of the circuite of the Earth, beyond which halfe, or on this ſide thereof the places muſt néedes bee néerer together, by reaſon of the roundneſſe of the Earth, and if either of the two places whereof, you would know the diſtance, be not expreſſed in the Globe, then learne to finde out the Longitude and Latitude thereof by ſome Table, whereof the firſt Meridian is ſuppoſed to paſſe through the Ilands of Canariæ, and marke vpon the Globe where the ſaid Longitude and Latitude doe croſſe, for there ought that place to ſtand which is miſſing, to which place direct the one fóote of your Compaſſes, and then worke as before is taught. And by this meanes you may alſo know the diſtance betwixt any two Starres, contained in the Globe.

PROPOSITION. V.

To know how one place beareth from another.

Though, you may partly find out this, by marking the direction of the lines, proceeding from the Marriners Compaſſe, ſet downe in the Globe: yet in mine opinion it is readier to doe it, by applying the Flie deſcribed in my little Treatiſe of vniuerſall Maps, vnto the Globe, by ſetting the Center thereof, vpon the firſt place from whence you goe, and by drawing a thread through that place whereto you would goe, in ſuch order as is there taught. So you ſhall find Venice to beare from London, South Eaſt and by Eaſt, and Ieruſalem to beare from London Eaſt, South Eaſt, and two quarters more towards the South. But Gemma Friſius teacheth, to know by the Globe how one place beareth from another, thus: hauing ſet the Globe, and alſo the Zenith of the quadrant of Altitude, at ſuch Latitude as the firſt place or Region hath, from whence you would goe, bring that firſt place vnder the brazen Meridian, and there ſtay the Globe, vntill you haue brought the quadrant of Altitude to the ſecond place, and the nether end of the quadrant of Altitude, will ſhew you vpon the Horizon amongſt the windes, how the ſecond place beareth from the firſt: ſo ſhall you find Hiſpaniola to beare from Spaine right Weſt. Theſe be the chiefeſt Propoſitions, belonging to the vniuerſall Map, wherewith the Terreſtriall Globe is couered, and therefore I will now ſet downe thoſe that belong to the Sunne, which may be done, as well by the one Globe as by the other, and firſt how to find out the place of the Sunne.

PROPOSITION. VI.

How to find out by the Globe the place of the Sunne, that is to ſay, the degree and minute of that Signe, wherein the Sunne is euerie day throughout the yeare.

Though the ſureſt way bee to find it out by the Ephemerides, which ſheweth the verie minute, yet without hauing reſpect to the minute, you may find it out by the Globe thus. Seeke out the day of the moneth vpon the Horizon, and that will point you to the degree of the ſigne, wherein the Sunne is that day: As for example, the 6. day of May, pointeth right to the 25. degree of Taurus, the Globe ſtanding leuell, and your rule being rightly laid vpon the Horizon: but during the leap yeare, you muſt adde one degree more then the Horizon ſheweth, euery day from the beginning of the leape yeare throughout all that yeare.

PROPOSITION. VII.

How to rectifie the Index of the houre-wheele, for euerie ſeuerall day throughout the yeare.

Hauing placed the Globe at your Latitude, and alſo found out the degree of the Sunne, as is before taught, bring that degree of the Sunne to the brazen Meridian, and there ſtaying it with the one hand, turne with your other hand, the Index of the houre-wheele, to the higheſt part of the ſaid wheele, marked with the number of 12. ſetting the point of the Index, iuſt with the ſtreeke of the wheele, made to ſhew the houre of 12. or noone-tide, and that will ſerue your turne for all that day, and thus muſt you doe euerie day, in which you haue to vſe the helpe of the ſaid houre-wheele for any purpoſe.

PROPOSITION. VIII.

How to know euerie day at what houre the Sunne riſeth or ſetteth.

Hauing ſet the Globe at your Latitude, and rectified the Index of the houre-wheele by the ſeuenth Propoſition, turne the Globe to the Eaſt, ſo as the degree of the Sunne may touch the Horizon, and then the Index of the houre-wheele will ſhew you at what houre the Sun riſeth. Againe, if you bring the ſaid degree of the Sunne vnto the Weſt part of the Horiſon, the Index of the houre-wheele will ſhew you at what houre he goeth downe. As for example, Anno 1590. the third of Iune, the Sunne being in the 21. degree 3'3, of Gemini. I bring the point to the very edge of the Horizon on the Eaſt part thereof, and there ſtaying it, the Index of the houre-whéele ſheweth that the Sunne riſeth 8'. before foure of the clocke in the morning: and the ſaid point of the Ecliptique, being turned to the Weſt part of the Horizon, the Index ſheweth that he ſetteth 8'. after 8. of the clocke at night.

PROPOSITION. IX.

How to know in what part of the Horizon the ſunne riſeth and ſetteth euery day.

Seeke the degree of the Sunne in the Ecliptique line, and turne it to the Eaſt part of the Horizon, then you ſhall ſee whether it riſeth iuſt Eaſt or not, and whether it inclineth towards the South, or towards the North, and likewiſe by bringing the ſaid degree to the Weſt part of the Horiſon, you ſhall ſee in what part of the ſaid Horizon hee goeth downe: As for example, in the laſt Propoſition the Sunne being in the 21. Degrée, 3'3. of Gemini, and brought to the Eaſt part of the Horizon, I find that the Sunne did riſe diſtant from the Eaſt towards the North 38. degrées, 3'0. of the Horizon, which is thrée points and ſomwhat more of the Marriners Compaſſe from Eaſt towards the North, ſo as the Sun riſeth Northeaſt and by Eaſt, and a litle more Northward, and the ſaid place of the Sun being brought to the Weſt part of the Horizon, I find that he ſetteth North Weſt and by Weſt, and ſomewhat more Northward.

PROPOSITION. X.

How to know the length of euery day and night through-out the yeare, as well by helpe of the houre-wheele, as by counting the degrees vpon the Horizon.

Firſt you muſt know when the Sunne riſeth and ſetteth by the eight propoſition, then looke how many houres the Index doth go from the Sun riſing to the Sun ſetting, and that is the length of the day: which number if you take from 24. the night will appeare: as for example, knowing by the eight propoſition, that the Sun being in the 21. degrée, 3'3. of Gemini, riſeth 8' before 4. in the morning, and goeth downe 8' after 8. of the clocke at night, I find by counting the houres which the Index of the houre-whéele hath run, that the length of the day is 16. houres and 1'6. which you may know alſo by counting the degrées vpon the Horizon from the place of the Sunnes riſing, vnto the South-point of the ſayd Horizon, which you ſhall find to bee 128. degrées, which being doubled, maketh 256. degrées, which if you diuide by 15. it will make 16. houres and 1'6. as before.

PROPOSITION. XI.

How to know by the Globe, how much the Sunne declineth euerie day throughout the yeare, from the Equinoctiall.

Hauing found the place of the Sunne, bring the ſame to the brazen Meridian, and by counting how many degrees are betwixt that place & the Equinoctiall, you ſhall know what declination the Sunne hath that day: As for example, ſuppoſing the Sun that day you ſeeke, to bee in the firſt degree of Gemini, bring the ſaid degree of the Ecliptique, to the brazen Meridian, and you ſhall find vpon the ſame Meridian, the Sunne to be declined from the Equinoctiall Northward, almoſt 20. degrees. Againe, ſuppoſing the Sunne to bee in the firſt degree of Aquarius, if you bring the ſaid degree of the Ecliptique vnto the Meridian, you ſhall find the declination of the Sunne, to be almoſt 20. degrees Southward.

PROPOSITION. XII.

How to know by the Globe, the Meridian Altitude of the ſun, that is to ſay, his height at noontide, euerie day throughout the yere, and how far he is then diſtant from your Zenith.

Bring the place of the Sunne, that day you ſeeke to the brazen Meridian, & ſtaying it there, count vpon the ſaid brazen Meridian, how many degrees are contained betwixt the place of the Sunne, and the South point of the Horizon; and that is the Meridian Altitude of the Sunne for that day, which if you ſubſtract from ninetie, the remainder will ſhew how many degrees hee is diſtant, that day at noonetide from your Zenith: As for example, ſuppoſing the Sun to be that day you ſeeke, in the firſt degree of Taurus, bring that degree of the Ecliptique to the brazen Meridian, and ſtay it there vntill you

haue counted, how many degrees of the ſaid Meridian are contained betwixt the place of the Sun, and the South point of the Horizon, & you ſhall find the number of degrees to be 50. which is the Meridian Altitude of the Sunne for that day, which 50. degrees, being taken out of 90. there remaineth 40. and ſo many degrees the Sunne is that day at noontide, diſtant from your Zenith. The like order is to be obſerued, in ſeeking to know the Meridian Altitude of any ſtarre, or any other point in heauen.

PROPOSITION. XIII.

How to know the Altitude of the Sunne, at any other houre of the day.

Hauing rectified the Index of the houre-wheele, by the ſeuenth Propoſition, if the houre which you ſeeke be in the forenoone, turne the Globe, ſo as the Index of the houre-wheele may touch that houre of the forenoone, at which you deſire to know the Altitude of the Sunne, and there ſtay the Globe, vntill you haue brought the quadrant of Altitude, on the Eaſt ſide of the Globe, vnto the place of the Sun, ſo ſhall you find vpon the ſaid quadrant, the Altitude of the Sunne at that houre. And, if you deſire to know the Altitude of the Sunne, at any houre in the afternoone, then turne the Globe ſo, as the Index of the houre-wheele, may touch the houre of the afternoone, and there ſtay the Globe, vntill you haue brought the quadrant of Altitude, on the Weſt ſide of the Globe, vnto the place of the Sun, and the ſaid quadrant will ſhew you the Altitude of the Sunne at that houre. As for example, I would know how high the Sunne is at eight of the clocke in the morning, the Sunne being in the firſt degree of Taurus: heere hauing rectified the Index of the houre-wheele, I turne the Globe ſo, as the Index of the houre-wheele, may lie vpon the eight houre of the forenoone, and there I ſtay the Globe vntill I haue brought the quadrant of Altitude, on the Eaſt-ſide of the Globe vnto the place of the Sunne, whereby I find the Altitude of the Sunne at that houre to be almoſt 28. degrees. Againe, if you will know how high the Sun is being in the ſame degree of the Ecliptique at 5. of the clocke in the afternoone, then turn the Index of the houre-wheele, ſo as it may touch that houre, and ſtay it there vntill you haue brought the quadrant of Altitude, on the Weſt ſide of the Globe vnto the place of the Sun, ſo ſhall you find the Altitude of the Sunne to be at that houre 21. degrees.

PROPOSITION. XIIII.

How to know the houre of the day by the Globe.

THis is to be done two manner of waies, the firſt is thus, ſet the Globe in ſome open place whileſt the Sun ſhineth, and you muſt ſee that it ſtand both leuell, and alſo right North and South, as is taught in the firſt propoſition, & that the Index of the houre wheele be rectified according to the degree of the ſigne wherein the Sun is that day by the 7. propoſition, that done, ſet a needle in the place of the Sun, & turn the body of the Globe to and fro vntill the needle caſt no ſhadow at all, & there ſtaying the Globe, the Index of the hour wheele will ſhew you the houre of the day. But if you ſeeke the houre in the forenoon, remember to turne the Eaſt ſide of the Globe towards the Sun: if in the afternoone, then turne the Weſt ſide of the Globe towards the Sun. The ſecond way is thus, hauing rectified the Index of the hour wheele, take the Altitude of the ſun with ſome Quadrant or Aſtrolabe, and hauing marked the ſame Altitude vpon the quadrant of Altitude, apply it to the degree of the Sun on the Eaſt ſide of the Globe if it be in the forenoone: but if it be in the afternoone, apply the quadrant of Altitude to the degree of the ſun on the weſt ſide of the Globe, & the Index of the houre wheele will ſhew you the houre which you ſeek. As for example, the 6. of Iune, 1590. the ſun being in the 24 degree 2′4 of Gemini, I found by my Aſtrolabe the altitude of the Sun to be 48. degrees, which I marked vpon the quadrant of Altitude,

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and becauſe I tooke the Altitude of the Sun in the forenoone, I brought the quadrant of Altitude marked with that degree to the place of the Sun on the Eaſt ſide of the Globe, & there ſtaying the Globe, I found that the Index of the houre wheele did point to the 9. houre of the forenoone and ſomewhat paſt. The like is to be done to know any houre of the afternoon, ſo as you forget not to apply the quadrant of Altitude vnto the place of the Sun on the Weſt ſide of the Globe. And by taking the Altitude of any knowne ſtarre, and working in like manner as before, you ſhall know the houre of the night, as ſhal be taught hereafter when we come to treate of the ſtarres.

PROPOSITION. XV.

To know how much the vnequall houres, otherwiſe called the planetarie houres, doe differ from the Artificiall houres throughout the yeare, and how many minutes euery vnequal houre containeth.

YOu muſt firſt know by the tenth Propoſition, the length of the day, that is to ſay, how many hours it is long, & reduce thoſe houres into minutes, and diuide the product by 12. and the quotient, together with the remainder (if there bee any left after the diuiſion) will ſhew you the quantity of the vnequall houre of the day, that is to ſay, how many minutes it containeth. The like is to bee done to know the vnequall houre of the night, for hauing the length of the Artificiall night, worke as before, and you ſhall haue your deſire. As for example, knowing by the tenth propoſition, the length of the day, when the Sunne is in the 21. degree, 3′3. of Gemini, to be 16. houres 1′6. Here by reducing thoſe houres into minutes, and by diuiding the Product thereof by 12. you ſhall find the vnequall houre of the day, to containe 81. minutes and ½ of a minute, or 26. ſeconds, which is more than one whole Artificiall houre of the day by 21. minutes

and

and 20. ſeconds. Againe, knowing the length of the Artificiall night, by the ſaid Propoſition to be 7. houres, 44. minutes, if you doe reduce the ſame into minutes, and diuide by 12. you ſhall find thereby the vnequall houre of the night, to containe no more but 38. minutes, and 40. ſeconds, which is leſſe then the artificiall houre of the day, by 21. minutes, and 40. ſeconds.

PROPOSITION. XVI.

How to know euerie day, when the dawning of the day, and the twilight of the night beginneth and endeth, and the time of their continuance.

Hauing rectified the Index of the houre-wheele, by the ſeuenth Propoſition; firſt, find out the oppoſite point to the degree of the Sunne, and turne the Globe together with that oppoſite point, and alſo together with the quadrant of Altitude towardes the Weſt, ſo as the oppoſite point may meet euen with the 18. degree of the quadrant of Altitude, and ſtaying the Globe there, the Index of the houre-wheele will ſhew at what houre the dawning beginneth. As for example, I would know at what houre the dawning of the daie beginneth the 19. of Aprill 1590. when as the Sunne is in the 8. degree of Taurus, the oppoſite point whereof, is the eight degree of Scorpio; wherefore, I turne the Globe together with the ſaid point oppoſite, and alſo together with the quadrant of Altitude towards the Weſt, ſo as the ſaid point oppoſite, may meet euen with the 18. degree of the quadrant of Altitude, and there ſtaying the Globe, I find by the Index of the houre-wheele, that the dawning of the day beginneth at two of the clocke in the morning, and 20. minutes after, which dawning alwayes endeth when the Sunne riſeth, as in the former example, the Sunne being in the 8. degrees of Taurus, doth riſe 45. minutes after foure of the clocke in the morning, ſo as the continuance of the dawning, is two houres, and 25. minutes,

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for by taking two houres and 20. minutes out of foure houres and 45. minutes, there remaineth two houres & 25. minutes. Againe, the twilight beginneth when the Sun goeth downe, which in the former example is at ſeuen of the clocke and 1′5. Now to know when the twilight endeth, you muſt doe thus: Turne the Globe and the Quadrant of Altitude towards the Eaſt, ſo as the oppoſite point which is the 8. degree of Scorpio, may meet euen with the 18. degree of the ſaid quadrant, and the Index of the houre-wheele will ſhew you that the twilight endeth at nine of the clock and 4′5. after, ſo as the continuance of the twilight is two houres, and 3′0. for by taking ſeuen houres & 1′5. out of nine houres and 4′5. there remaineth two houres and 3′0. But you haue to vnderſtand, that the dawning and twilight is not alwaies to be knowne throughout the yeare by the Globe, for from the 11. day of May, to the 10. of July, you ſhall find, that the oppoſite point of the Sun will not agree iuſt with 18. degrees of the quadrant of Altitude: becauſe that no oppoſite point during that time will amount to aboue 16. or 17. degrees of the quadrant of Altitude at the moſt, becauſe the Meridian Altitude it ſelfe of any ſuch oppoſite point is not aboue 17. degrees, for during all that time, both dawning and twilight had neede in this our Latitude to bee accounted as night, vnleſſe you will make no night at all.

PROPOSITION. XVII.

How to know the aſcention of the Sunne both right and oblique.

Hauing ſet the Globe at your latitude, bring the degree of the Sunne to the Brazen Meridian, and there ſtaying it, marke at what number of Degrees the ſaid Meridian cutteth the Equinoctiall, counting that number from the firſt point of the Vernall Equinoctiall point to that Section, and that is the right aſcention. As for example, the

Sun

Sun being in the firſt degrée of Gemini, and brought the Meridian, you ſhall finde that the Meridian cutteth the Equinoctiall in the 58. degrée thereof, and that is his right aſcention. Now if you would know his oblique aſcenſion, beeing in the firſt degrée of Gemini, bring that degrée to the Eaſt part of the Horizon, ſo as it may touch the vpper edge thereof, and ſtaying the Globe there, looke what degrée of the Equinoctiall toucheth the Horizon at that inſtant, which you ſhall find to be the 30. degrée of the Equinoctiall, and that is his oblique aſcention. Theſe are the chéefeſt propoſitions that belong to the Sunne, and are to be found by either of the Globes, wherefore I will now procéede to thoſe propoſitions that are to be knowne moſt properly by the celeſtiall Globe. But firſt I will make a deſcription of the ſaid Celeſtiall Globe, whereby it ſhall plainly appeare, wherein the one Globe is like the other, and wherein the one differeth from the other.

PROPOSITION. XVIII.

The eighteene Propoſition, containing the deſcription of the celeſtiall Globe, and ſhewing wherein it is like or differing from the terreſtriall Globe.

THE Celeſtiall Globe is like to the Terreſtrial Globe, in that it is round, hauing both like Axeltrées, Poles, Houre-whéele with his Index, brazen Meridian, quadrant of Altitude of Braſſe or Latton, with his ſquare head or Zenith, and a halfe Circle of Braſſe or Latton called the ſemi circle of poſition, alſo a ſtanding foote with an Horizon of wood diuided into ſeuen ſeueral ſpaces, containing in a manner the ſelfe-ſame things that are before deſcribed in the Horizon of the terreſtriall Globe, alſo in the body of the celeſtiall Globe, are ſet downe certain Circles like vnto the terreſtriall Globe, that is to ſay, the Equinoctiall & the Ecliptique line. Moreouer, the foure leſſer Circles, that is to ſay, the two Tropiques

Tropiques, the Circle Arctique, and the Circle Antarctique. But the Celeſtiall Globe differeth from the Terreſtrial Globe in theſe foure things following. Firſt, the Celeſtiall Globe hath one thinne Demi-circle of Braſſe or Latton, more than the Terreſtriall Globe hath, which Demi-circle is diuided into two quarters, each quarter containeth 90. degrees, made ſo at each end as it may bee faſtened when need is, vpon the two Poles of the Zodiaque, to find thereby the Longitude and Latitude of euerie Starre, deſcribed in the Globe, and therefore may verie well bee called the Semi-circle of Longitude and Latitude. The ſecond difference is, that whereas the Terreſtriall Globe is traced with 12. Meridians, diuiding the Equinoctiall into 24. ſpaces, euerie ſpace containing 15, degrees. The Celeſtiall Globe is onely traced with 6. Meridians, diuiding the Equinoctiall into 12. ſpaces, euerie ſpace containing 30. degrees. The third difference is, that the Celeſtiall Globe hath not theſe 8. Parallels of Latitude, wherewith the Terreſtriall Globe is traced. The fourth difference is, that whereas the Terreſtriall Globe is couered with an vniuerſall Map, containing the 4. principall diuiſions of the earth, that is, Europe, Africa, Aſia, and America: the Celeſtiall Globe is couered with a Mappe, wherein are painted all the fixed Starres, that were knowne to the ancient Aſtronomers, diuided into 48. Images, with which Images, to the intent you might bee the better acquainted, and that you might the more readily find out any Starre deſcribed in the Globe, I thought good to ſet downe a particular deſcription of the ſaid 48. Images as followeth.

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PROPOSITION. XIX.

The 19. Propoſition containeth a particular deſcription of the 48. Images of the fixed ſtarres, that are in the Celeſtiall Globe, together with their ſundrie names, and alſo the names of ſo many ſtars as are named in the Globe, of which 48. Images, 21. are aſcribed to the North part of the firmament, 12. to the Zodiaque, and 15. to the South part of the firmament.

This deſcription is diuided into two parts, according to the twofold declination of the fixed Starres, that is to ſay, Northerne and Southerne: for thoſe ſtarres are ſaid to haue North declination, which are ſituated betwixt the Equinoctiall, and the North Pole, and thoſe to haue South declination which are ſituated betwixt the Equinoctiall, and the South Pole. And becauſe the ſixe great Circles, or Meridians, paſſing through the Poles of the world, doe diuide the Equinoctiall into twelue equall ſpaces, euerie ſpace containing 30. Degrées, I will beginne my deſcription at the firſt point of Aries, which is the Vernall Equinoctiall point, and ſo procéed towards the right hand round about the Globe, ſetting downe all ſuch Images, or parts of Images, as are ſituated towards the North Pole, and are contained in euerie ſeuerall ſpace betwixt two Meridians: & hauing deſcribed all the North part, I wil vſe the like order in deſcribing the ſouth part. And you may behold all the Northerne Images, by turning the Globe about with your hand, without taking the ſame out of his bed or ſeat, the Pole being eleuated aboue the Horizon. 50. or 60. degrees. But to view the Southerne Images, it ſhall be néedfull to take the Globe cleane out of his ſeat, and to hold it ſo as the North Pole may ſtand right vp, ſo ſhall you ſee euerie Southerne Image and ſtarre at your pleaſure. And yet to know how the Starres are ſituated in heauen, you had need to imagine your ſelfe to be within the Globe, in the verie Center thereof, and not without the Globe, for otherwiſe thoſe Starres that are ſituated in heauen, on your right hand, if you haue regard to the out-ſide of the Globe, will ſéeme to be on your left hand.

tuated

The Northerne Images, contained in the firſt ſpace, intercepted betwixt the firſt Meridian, and the ſecond Meridian.

IN this ſpace you ſhall firſt ſee, next vnto the Equinoctiall, the following Fiſh of the ſigne Piſces, together with the bond, both Southerne and Northerne, called in Latine Linum auſtrale & Septentrionale, alſo the knot of the bond, which is called Nodus, Syndeſmon, and Hipouraion, which is a faire Starre of the third bigneſſe.

Item, the firſt part of Aries, with the two Starres in his right horne, from the former Starre, whereof the Aſtronomers doe alwaies make their computation.

Item, the whole Image of Andromeda, her head and right arme excepted, in whoſe girdle is a Starre of the third bignes, called Mirach, and in her left foot a Starre of the third bignes, called Alamac.

Item, the Triangle, called Triangulus and Deltoton, with his foure Starres.

Item, the whole Image of Caſſiopeia, ſauing her right arme, and the vpper part of the backe of her chaire, in whoſe breaſt is a Starre of the third bigneſſe, called Shedar.

The Northerne Images, contained in the ſecond ſpace.

FIrſt, the head of the Whale, called Cetus, in whoſe ſnout is a ſtarre of the third bigneſſe, called Menkar.

Item, all the hinder parts of Aries, called in Greeke, Chrios, in Engliſh the Ramme.

Item, the right leg, necke, breaſt, right eare, and mozell of the Bull, in whoſe right thigh, towards the ſhoulder point, is a ſtar of the fourth bigneſſe, called Alſon, and in his breaſt a ſtarre of the third bigneſſe, called Alſo, and in his Mozell lying vpon his right legge, is another ſtarre of the third bigneſſe, called Alſon, and in his necke, towards the withers, are 7. ſtarres of diuers

bigneſſe

bigneſſe called by theſe diuers names, that is, Vigilie, Atlantides, Pleiades, & Athoratæ, commonly called the ſeuen Stars.

Item, the whole head of Meduſa, called Caput Meduſæ vel Gorgonis, and Ras Algol.

Item, the whole Image of Perſeus, otherwiſe called Chelube, his right hand, ſword, and right foot excepted.

The Northerne Images contained in the third ſpace.

Firſt, the left legge of the Bull hauing two ſtarres thereon: moreouer his head, hornes, and moſt part of his right eare, on whoſe left eye is the ſtarre of the firſt bigneſſe, called Oculus Tauri, Palilicium, and Aldebaran, alſo in his face are certaine leſſer ſtarres, called Succulæ and Hyades.

Item, the vpper part of Orion otherwiſe called Alguze, holding a club in his right hand, and a Lions ſkinne in his left hand, on whoſe right ſhoulder is a Starre of the firſt bigneſſe, called Bed Alguze, and on his left ſhoulder a Starre of the ſecond buſineſſe, called Bellatrix.

Item, the left foote of the former Gemini, containing two Stars of the fourth bignes, whereof the one is called Propous.

Item, the whole Image of Auriga, otherwiſe called Ericthonius & Heniochos, holding a raine and a whip in his right hand, and hauing a Goat hanging on his backe, which hath two little Goates ſucking her behind, which bee two Starres of the ſecond bigneſſe, called by diuers names, as Hedi, Heriphoi, and Sadateni, and in the flanke of the Goat is a Starre of the firſt bigneſſe called Hircus, Aix, Aolenic and Alhaior.

The Northerne Images contained in the fourth ſpace.

Firſt the whole Image of the little Dog, in whaſe left flanke is a Starre of the firſt bigneſſe called Canis minor, Procion, Algomeiſa, and Alſahere.

Item, the whole Image of the two twinnes called Gemini or Didimoi, the left foote of the former twinne onely excepted, which former twiune is called Apollo, Caſtor, Anhelar, and the

other is called Pollux, and Abrachaleus, in whoſe left eare is a ſtarre of the ſecond bigneſſe, called Ras Alguze.

Item, the taile and halfe the bodie of Cancer.

Item, the Nozell of the great Beare, whereon is a ſtarre of the fourth bigneſſe.

The Northerne Images contained in the fifth ſpace.

Firſt, the head and necke of Hydrus.

Item, the fore-part of Cancer, called in Greeke Carchinos, vpon whoſe right Clea, is a ſtarre of the fourth bigneſſe, called Acubene, and betwixt his head, and his right Clea, is a ſtar called Preſepe, Phatue, and Meelleph, and on his backe are two ſtarres, called Aſelli and Onoi.

Item, the forepart of Leo, againſt whoſe heart is a ſtarre of the firſt bigneſſe, called by theſe names, Cor Leonis, Regulus, Beſileus, and Calbalezet.

Item, the fore-part of the great Beare, called Vrſa maior, Arctos Eliche, and Caliſto.

The Northerne Images contained in the ſixth ſpace.

Firſt, the hinder part of Leo, otherwiſe called Alezet, in whoſe taile is a ſtarre of the firſt bigneſſe, called Cauda Leonis, and Deneb Alzet.

Item, the head and ſhoulders of Virgo.

Item, the darke ſtarre of Bernices haire.

Item, the hinder parts of the great Beare, his taile excepted

Item, the hinder parts of the Dragons taile, containing two ſtarres of the fourth bigneſſe.

The Northerne Images contained in the ſeuenth ſpace.

Firſt, the moſt part of Virgo, who is otherwiſe called Parthenos, Erigone, Preuindemiator, Protigiter, Almucedic, and Alaraph.

Item, the left leg, and left arme of Bubulcus, otherwiſe called, Bootes & Vociferator, Arctophilax and Lanceator, betwixt whoſe legges is a Starre of the firſt bigneſſe, called Arcturus, Aſimech and Alramech.

Item, Bernices haire, called Cincinnus, Ceſaries, Plochamos, Berenices crinis, and Trica.

Item, the taile of the great Beare, containing three Stars of the third bignes, wherein that next his rumpe is called Alioт, and that which is in the tippe of his taile, is called Benenacz.

Item, a part of the Dragons taile, containing two Starres, ſtanding nigh together, nigh vnto the Circle Arctique.

The Northerne Images contained in the eight ſpace.

FIrſt, the head and necke of the Serpent, called Anguis, Serpens, Engchelis and Ophis.

Item, the crowne of Ariadna, called Corona gnoſia, Stephanos Ariadnis, and is commonly called Corona Septentrionalis, that is, the Northerne Crowne, in which is a Starre of the ſecond bigneſſe, called Malfelcare, Alpheta and Muniir.

Item, the moſt part of the Image of Bubulcus, hauing a club in his right hand, in whoſe left ſhoulder is a ſtarre of the fourth bigneſſe, called Ceginus, and there is another of the fourth bigneſſe in his club, right againſt his face, called Incalurus.

Item, the fore-part of the little Beare, called Vrſa minor, Arctos and Cinoſura.

The Northerne Images contained in the ninth ſpace.

FIrſt, the vpper part of Serpentarius, otherwiſe called Ophioncos and Alangue, in the Crowne of whoſe head is a Star of the third bigneſſe, called Iras Alangue.

Item, the whole Image of Hercules, with the Lyons ſkinne hanging on his left arme, otherwiſe Engonaſi, Algethi, Neſſus, and Ignotum idolum (his right hand holding the club, and his right legge excepted) in whoſe head is a Starre of the third bigneſſe, called Ras Algethi, and this Image lieth groueling, with his heeles towards the North Pole, and his head towards the

Equinoctiall, which meeteth almoſt with the head of Serpentarius.

Item, the head of the Dragon, called Draco and Aben, in whoſe head is a Starre of the third bigneſſe, called Ras Aben.

Item, a part of his taile containing ſixe Starres.

Item, the hinder part of the little beare, containing two ſtars.

The Northerne Images contained in the tenth ſpace.

FIrſt, the vpper part of Antinous, hauing at each elbowe, a ſtarre of the third bigneſſe.

Item, the laſt end of the Serpents taile, in the tippe whereof is a ſtarre of the fourth bigneſſe.

Item, the whole Image of the Eagle, called Aquila, Vultur volans, Aetos and Alcair.

Item, the whole Image of the Shaft, called Sagitta, Telum and Hoiſtes.

Item, the whole Image of the Harpe, called Lira & Alohore, that is to ſay, Vultur cadens, and Chelis; in the vpper part whereof towards the left hand, is a faire ſtar of the ſecond bigneſſe, called Fidicula, Lira, Alangue, Vega and Brineck.

Item, the head, necke, and left wing of the Swanne, called Auis, Cignus, Olor, Hornis, Adigege, and of ſome Gallina.

Item, the necke, bodie, and fore-part of the Dragon, containing a eleuen Starres.

Item, part of the little Beares taile, containing one Starre, next to his rumpe of the fourth bigneſſe.

The Northerne Images contained in the eleuenth ſpace.

FIrſt, the Crowne of Aquarius his head, containing one Star of the fift bigneſſe.

Item, the little horſe, called Equus and Hippos, whoſe necke is incloſed with a cloud, and in his head are foure little ſtarres.

Item, the head and two fore-feete of the winged horſe, called Pagaſus, on whoſe right noſtrell is a ſtarre of the third bignes, called Eniph Alpharaz.

Item, the Dolphin, called Delphinus, containing ten Stars, whereof one is of the third bigneſſe.

Item, the bodie, legges, and the right wing of the Swanne, which lieth on her backe, with her belly vpward, in whoſe bodie towards the taile, is a faire ſtarre of the ſecond bigneſſe, called Deneb, Adigege, and Arided.

Item, the right arme and right legge of Cepheus, on whoſe right ſhoulder is a ſtarre, called Alderaimim.

Item, part of the little Beares taile, containing the middle ſtarre of his taile.

The Northerne Images contained in the twelfth ſpace.

FIrſt, the moſt part of the former Fiſh, of the ſigne Piſcis, together with part of her band.

Item, the necke, bodie, and wing of Pegaſus, otherwiſe called Equus Gorgoneus, and Alpharaz, riſing out of a cloud, in which cloud the head of Andromeda, hauing on the right ſide thereof, a faire ſtar of the ſecond bigneſſe, and in the right wing of Pegaſus, is a ſtar of the ſecond bigneſſe, called Marcab Alpharaz, and on his right ſhoulder another ſtarre of the ſecond bigneſſe, called, Scheat Alpharaz.

Item, the right arme and hand of Andromeda, holding part of her Chaine, in the Ring, whereof is a ſtarre of the fourth bigneſſe.

Item, the right arme of Cepheus.

Item, the tip of the little Beares taile, in which is the North ſtarre, called Alrucuba of the third bigneſſe.

The names of the Images contained in the Celeſtiall Globe, betwixt the Equinoctiall and the South Pole, together with ſo many ſtarres as are named in that part of the Globe, beginning, as I did before in deſcribing the Northerne Images, at the Vernall Equinoctiall point, and ſo proceed from ſpace to ſpace, contained betwixt euerie two Meridians towards the right hand.

The Southerne Images contained in the firſt ſpace, beginning at the Vernall Equinoctiall point.

FIrſt, the moſt part of the Whale called Cetus, Piſtrix, and Balena (his head and fore-part of his belly excepted) in the mid bodie, whereof towards the backe, is a ſtarre of the fourth bigneſſe, called Baten Kaetos, and in the lower part of his tayle is another ſtarre of the third bigneſſe, called Deneb Kaitos.

The Southerne Images contained in the ſecond ſpace.

THe fore-part of the Whales belly and his ghilles, containing fiue ſtarres.

Item, the moſt part of the floud Eridanus, called of ſome Nilus, and in Greeke Potamos Eridanos, containing 22. ſtarres, whereof one is called Angetenar, which is about the middeſt of the Floud nigh vnto the Whales belly, and there is in the verie end of the Floud, another ſtarre of the firſt bigneſſe, called Acarnar.

The Southerne Images contained in the third ſpace.

FIrſt, the nether part of Orion or Alguze, from the middle of his backe downe-ward, in whoſe girdle are thrée faire ſtars, whereof the middle ſtar is of the ſecond bigneſſe, called Orion or Alguze.

Item, another part of the floud Eridanus, which ſéemeth to come from the left foote of Orion, which ſtarre in the left foot is called Algebar, Rigel, Alguze.

Item, the whole Image of the Hare, called Lepus and Lagos, containing twelue little ſtarres.

Item, the reſt of Eridanus, containinh foure ſtarres, whereof there is one called Beemum of the fiſt bigneſſe.

The Southerne Images contained in the fourth ſpace.

FIrſt, the whole Image of the great Dog, called Canis maior, and Syrios, in whoſe mouth is a ſtarre of the firſt bigneſſe, called Aſceher and Alhabor.

Item, the fore-part of the great ſhip Argos, with her two Oares, hauing a Scutchen with foure Starres, the greateſt whereof being of the third bigneſſe, is called Markeb, and vnder the vpper hatches, in the fore-part of the ſhip is a Starre of the fifth bigneſſe, called Alphard, and in the left Oare towards the South Pole, is a faire Starre of the firſt bigneſſe, called Canopus and Suhel.

The Southerne Images contained in the fifth ſpace.

Firſt, the mid part of the Serpent, called Hydrus and Aſuia, in the which is a faire Starre of the ſecond bigneſſe, called Alphard.

Item, the hinder part, maſt, and top of the ſhip Argos, which ſeemeth to come out of a cloud, containing diuers Starres of diuers bigneſſe without name.

The Southerne Images contained in the ſixth ſpace.

ITem, another part of Hydrus, whereupon ſtandeth the Image of the cuppe or bowle called Crater, Vas and Patera, and alſo the Crowes head.

Item, the hinder part of Centaurus, in euery part whereof are diuers Starres without name.

The Southerne Images contained in the ſeuenth ſpace.

Firſt, the left wing of the ſigne Virgo and her left hand, holding an eare of wheat, whereon is a Starre of the firſt bigneſſe, called Spica Virginis, Stachis, Acimon, Alacel & Azimech.

Item, the Crow called Coruus and Corax, his head and necke excepted, in whoſe left wing is a Starre of the fourth bigneſſe, called Algorab.

Item, the reſt of Hydrus, whereon the Crow ſtandeth, containing three Starres without name.

Item, the reſt of Centaurus or Chiron, with his bore-ſtaffe trimmed with boughes, his right hand and right feet excepted.

The Southerne Images contained in the eight ſpace.

THe whole Image of Libra, the Ring onely excepted.

Item, the fore-part of Scorpio, whoſe fore Cleas doe lie vpon the two ballances, that is to ſay, his right Clea vpon the North ballance, and his left Clea vpon the South ballance, hauing vpon each Clea a Starre of the ſecond bigneſſe.

Item, part of the Serpent called Anguis or Orphis, hauing one Starre of the fourth bigneſſe.

Item, the left hand of Serpentarius, holding part of the Serpent, vpon which hand are two Starres of the third bigneſſe, called Yedd.

Item, vpon the head of Scorpio are three Starres of the third bigneſſe, ſtanding all in a row, and diuers others, as well vpon his backe, as vpon his left little Clea without name.

Item, the whole Wolfe called Fera, Lupus and Therion.

Item, the right hand of Centaurus, holding the ſaid Wolfe by the belly, in both which are diuers Starres without name.

Item, the right foote of Centaurus, in which is a faire Starre of the firſt bigneſſe, and is called by the name of Centaurus.

The Southerne Images contained in the ninth ſpace.

Firſt, the nether part of Serpentarius, that is to ſay, from his midde backe downeward, hauing the Serpent winding betwixt his legges, and aboue his right arme, in both which are diuers Starres without name.

Item the hinder part of Scorpio, from his midde body, to the outtermoſt end of his taile, who hath diuers names, as Scorpius Nepa, Alatrab, in the midſt of whoſe bodie is a faire Starre of the firſt bigneſſe, called Cor Scorpionis, Antares and Chalb Alatrab, and in the tip of his taile are two Starres of the third bigneſſe, called Alaſcha and Scomlec Alatrab.

Item, the moſt part of the Bow, with the head of the ſhaft of Sagittarius, and his right foote, in all which parts are diuers Starres without names.

Item, the Altar with the flame and ſmoke, called Ara, Thuribulum, lar, ſacrarium, thimiaterion.

The Southerne Images contained in the tenth ſpace.

The lower part of Antinous, from the breaſt downeward kneeling vpon an Altar, containing 4. ſtars without name.

Item, the forepart of Capricornus his head.

Item, the Image of Sagittarius, otherwiſe called Crotus and toxeuter (his bow, the end of his arrow, and his right foot excepted) hauing diuers ſtarres without name.

Item, the Southerne Crowne, called Corona Auſtralis, and Notios Stephanos, and of Aratus, it is called Dinotos Cyclos, that is to ſay, the Southerne Circle, which Crowne is placed betwixt the two fore-legges of Sagittarius, and in the ſaid Crowne are diuers ſtarres, amongſt which there is one of the ſecond bigneſſe touching the left knee of Sagittarius, called Corona Auſtralis, who alſo hath on his left foote another ſtarre of the ſecond bigneſſe without name.

The Southerne Images contained in the eleuenth ſpace.

The fore-part of Aquarius, otherwiſe called Ganimedes, and Hydrochos, holding a hand-kercher in his left hand, wherein are three ſtarres, and hath diuers ſtarres in his bodie without name.

Item, the whole Image of Capricornus, otherwiſe called Pan-Aigoceros, and Algedi; the fore-part of his head onely excepted, in whoſe tayle is a ſtarre of the fourth bigneſſe, called Deneb Aldegi.

Item, the hinder part of the Southerne fiſh, hauing diuers Starres without name.

The Southerne Images contained in the twelfth ſpace.

First, Aquarius his right hand, holding the water-pot, called Vrna and Chalpe, out of the which he powreth the water

downe

downe into the mouth of the Southerne fiſh, which water is called Aqua & Hydor, in which are diuers ſtars without name.

Item, the lower belly-part of the former fiſh of the ſigne Piſcis, wherein are two ſtarres without name.

Item, both the thighes and legges of Aquarius, vpon the calfe of whoſe right legge is a ſtarre of the third bigneſſe, called Scheat Aquarij, and Crus Aquarij.

Item, the head of the Southerne fiſh, called Piſcis Meridionalis, and Icthis notios, in whoſe mouth is a faire ſtarre of the firſt bigneſſe, called Fomahant.

But you haue to vnderſtand, that beſides the 15. Southerne Images beforementioned, there are lately found out by the Portugales and others, that haue ſailed in the Eaſt and Weſt Indies, foure other Images towards the South Pole, as the Croſſe or Crozier, the South Triangle, Noahs Doue or pigeon, and another Image made like a Philoſopher, called Polophilax, all which are ſet downe in the Celeſtiall Globe, lately ſet forth by M. Emeric Mullineux at the charges of M. William Sanderſon, of whom I lately bought both the Globes, that is, the Terreſtriall & Celeſtiall: and I wiſh that the Longitude, Latitude and declination of euery ſtarre, contained in the ſaid foure Images were truly ſet downe, for Plancius maketh ſome doubt thereof. Notwithſtanding, if you be deſirous to know the Longitude, Latitude, and declination of the ſaid ſtarres, by helpe of the foreſaid great Globe, then you muſt worke as I doe ſhew you hereafter, in ſeeking for any ſtarre contained in Mercator his Globe, ſo ſhall you haue your deſire.

Moreouer, to moſt of the ſtarres deſcribed in the Globe, are annexed the Characters of ſome of the 7. Planets, to ſhew the nature and qualitie of the ſtars, and ſome ſtars are alſo marked with ſome one letter or other, the more readily to find out thereby the foreſaid Characters. As for example, to Cor Leonis, are annexed the Characters of Iupiter and Venus, and vnder the ſaid ſtarre is the letter m. to ſhew the Characters which are not alwaies ſet hard by the ſtarre, but ſometime a good diſtance off, for where the Characters are ſet nigh vnto the ſtarre, there needeth no letter, as in the ſtarre called Spica Virginis,

whereunto

wherunto are annexed the characters of Mars and Venus, without any letter to ſignifie the ſame; and where diuers Starres bee of one ſelfe qualitie, they are ſeuerally marked with letters of one ſelfe ſame ſhape, as about the Star Spica Virginis, you ſhall find diuers little Starres, each one marked with the letter h. ſignifying their nature to be all one, that is, to participate of Mars and Venus, to whoſe Characters is alſo ioyned the letter h. ſignifying that they be of that nature and qualitie.

The Characters are theſe heere following, ſet ouer euerie Planets head.

♄	♃	♂	☉	♀	☿	☽
Saturne.	Iupiter.	Mars.	Sol.	Venus.	Mercurie.	Luna.

The nature of euerie one of the Planets here followeth.

SAturne is cold and drie. Iupiter is temperately hotte and moyſt. Mars is extreamely hotte and drie. Sol hotte and ſomewhat drie. Venus is temperately cold and moyſt, Mercurie is of a changeable nature, and pliant to the nature, be it good or bad of euerie other Planet or fixed Starre whereto it is ioyned. Luna is cold and moyſt.

Beſides, the Images and Starres both Northerne and Southerne aboue mentioned, there is alſo ſet downe in the Celeſtiall Globe, a certaine impreſſion called in Greeke Galaxia, that is to ſay, the milke white way, the deſcription whereof heere followeth.

A briefe deſcription of the milke white way, called in Greeke Galaxia, *and in Latine* Via lactea.

THis way as Garceus writeth, proceedeth from the ſigne Gemini, and ſo paſſeth through the legs and loynes of Ericthonius, and from thence through the right ſide of Perſeus, and then through the whole Image almoſt of Caſſiopeia, and from thence through the left wing of the

Swan called Auis, Gallina and Cignus, & from thence through the Image called in Latine Telum, in Engliſh a Dart, ſhaft, or quarrell, and from thence through the flying Eagle, called in Latine Vultur volans, & from thence through the greateſt part of Sagittarius his bow, and from thence through the Altar called Ara and Thuribulum, and from thence through the legs of Centaurus, and ſo to the ſhip called Argos, from whence riſing againe, and paſſing through part of the great Dog called Canis maior, it returneth againe to Gemini.

Thus, hauing deſcribed vnto you all the fortie eight Images, and ſhewed the names of as many Starres as are named in the Globe, and alſo the milke white way, I minde now to proceed to the Propoſitions belonging to the fixed Starres deſcribed in the Globe, as followeth.

PROPOSITION. XX.

How to find out in Heauen, any vnknowne ſtarre deſcribed in the Globe, two manner of wayes, that is, either by the helpe of ſome knowne ſtarre, or elſe by knowing the true houre of the night.

THe firſt and ſureſt way is thus: Take with your Quadrant or Aſtrolabe the Altitude of the knowne Starre, marking therewith in what part of the heauen the ſame is ſituated, Eaſt or Weſt, North or South, and then hauing ſet your Globe right North and South, and at the true Latitude of the place where you are, bring the Quadrant of Altitude to the ſaid Starre, and therewith turne the Globe, vntill you ſee that the ſaid Starre hath the like place, and the like Altitude in the Globe that it had in heauen, then keeping the Globe ſtill at that ſtay, ſeeke in the Globe the Starre that you would find out in the firmament, and marke well in what part of the Globe it is ſituated, and how it beareth from the knowne ſtarre, either Eaſt, Weſt, North or South, and bring the

the quarter of Altitude to that ſtarre, that you may know the Altitude thereof by helpe of the ſaid quadrant, which Altitude once taken, turne your eyes towards that part of the firmament, and hauing placed the Diopter of your Aſtrolabe at that Altitude, looke what ſtarre in that part of the firmament doth anſwere to ſuch Altitude, and that is the ſtarre which you ſeeke, whoſe name for the moſt part is ſet downe in the Globe. The ſecond way is thus, hauing learned the true houre of the night by ſome clocke or watch, bring the degree of the Sunne vnto the brazen Meridian, and holding it there, ſet the Index of the houre-wheele iuſt at the 12. houre, that done, turne the bodie of the Globe to or fro, vntill the Index of the houre-wheele fal iuſt vpon the houre which you ſeeke, and keeping the Globe at that ſtay, ſeeke out the vnknowne ſtarre in the Globe, and conſider how it beareth from you in the Globe, either Eaſt, Weſt, North or South, then bring the quadrant of Altitude to the ſtar, that you may know thereby what Altitude it hath in the Globe, which once found, and hauing ſet the Diopter of your Aſtrolabe at that latitude, turne your eye towards that part of the firmament, whereunto the place of the ſtarre found in the Globe directeth you, and that ſtar which anſwereth to that Altitude, is the ſtarre which you ſeeke. But this way is not ſo ſure as the other way firſt taught, vnleſſe you know the true houre indeed.

PROPOSITION. XXI.

How to know by the Globe, the Meridian Altitude, which is the higheſt Altitude of any Starre, and alſo how high or low hee is at any other time.

HAuing ſet the Globe at your Latitude, bring the ſtar to the brazen Meridian, and there ſtaying it, number vpon the brazen Meridian, the degrees contained betwixt the ſaid ſtarre, and the South or North point of the Horizon, according as the ſtarre is ſituated eyther Northward or Southward; for ſo in the Latitude 52. you ſhall find the Meridian, or higheſt Altitude of the Starre Arcturus or Bubulcus, to be 6. degrees. But if you would know his Altitude at any other time, then you muſt rectifie the Index of the houre-wheele, by the ſeuenth Propoſition, and hauing ſet the Index, at the houre wherein you ſeeke, ſtay the Globe there, vntill you haue brought the quadrant of Altitude vnto the ſtarre, and that will ſhew the Altitude of the ſtarre, at the houre if it be aboue the Horizon.

PROPOSITION. XXII.

How to know by the Globe, what ſtarres are aboue the Horizon, at any time of the day or night.

OF ſtarres according to diuers Latitudes, ſome are alwaies aboue the Horizon, and ſome are alwaies vnder the Horizon, and ſome doe both riſe & ſet. If you would know what ſtars bee aboue the Horiſon in the day time, then hauing rectified the Index of the houre-wheele by the ſeuenth Propoſition, take the Altitude of the Sunne, with your Aſtrolabe or Quadrant, and therewith conſider whether the Sunne be in the Eaſt part, or in the Weſt part of the Firmament. Then bring the Quadrant of Altitude, on the Eaſt or Weſt ſide of the Globe, according as you ſaw the Sunne at that preſent to be in the firmament, and make the degree of Altitude, marked in the Quadrant of Altitude, to meet euen with the degree of the Ecliptique line, wherein the Sunne is that day, and there ſtaying the Globe, you ſhall ſee all the ſtars that be aboue the Horizon at that preſent, as well on the Eaſt ſide, as on the Weſt ſide of the Globe, and the Index will ſhew you at what houre you tooke the foreſaid Altitude. But if it bee in the night ſeaſon, and that the Stars doe appeare, take with your Aſtrolabe the Altitude of ſome knowne Star, and by doing as is before taught, you ſhall haue your deſire. But you muſt not forget firſt of all to rectifie the Index of the houre-wheele, by the ſeuenth Propoſition.

PROPOSITION. XXIII.

How to know by the Globe, at what time any ſtarre riſeth aboue the Horizon, mounteth to the higheſt, and ſetteth: and with what degree of the Ecliptique hee riſeth, mounteth: and ſetteth: and alſo in what part of the Horizon hee riſeth and ſetteth.

Hauing rectified the Index of the houre-wheele, by the ſeuenth Propoſition, bring the Star to the Eaſt part of the Horizon, ſo as it may touch the edge thereof, and the Index of the houre-wheele will ſhew at what houre he riſeth, & by looking at that inſtant to the Ecliptique line, you ſhall ſee what degree of the Ecliptique ariſeth then with him. That done, bring the ſaid Star to the brazen Meridian, & the Index of the houre-wheele wil ſhew at what houre he is at the higheſt: and there ſtaying the Globe, marke what degree of the Ecliptique line, doth fall right vnder the brazen Meridian at that inſtant, for that degree is ſaid to accompany him, when hee is at his higheſt. Then bring the ſaid Starre to the Weſt part of the Horizon, and you ſhall find by the Index of the houre-wheele at what houre he ſetteth, and what degree of the Ecliptique doth accompany him at his ſetting. As for example, I would know the ſixteenth day of Iune 1590. the Sunne being the fourth degree of Cancer, when Arcturus, otherwiſe called Bubulcus, and Lanceator doth ariſe, mounteth to the higheſt, and ſetteth: heere hauing rectified the Index of the houre-wheele, by the ſeuenth Propoſition, I bring the ſaid Star to the Eaſt part, and verie edge of the Horizon, & I find that he riſeth a little before twelue of the clocke at noone, and that the 28. degree and 3'0. of Virgo riſeth with him, and by looking amongſt the winds vpon the Horizon, right againſt the place of his riſing, I find that he riſeth North-eaſt and by Eaſt. Secondly, by bringing the ſaid ſtar to the brazen Meridian, the Index of the houre-wheele ſheweth that he is at his higheſt, halfe an houre after ſeuen of the clocke at night, and is then plaine South, and that the 29. of Libra, doth

doth then accompany him. Thirdly, by bringing the ſaid ſtarre to the Weſt part of the Horizon, the Index of the houre-wheele ſheweth that hee ſetteth, or goeth downe a quarter of an houre before foure in the morning, and that the fourth degree of Capricornus doth accompany him at his ſetting: and by looking there vpon the Horizon, I find amongſt the winds, that the ſaid ſtarre ſetteth Northweſt and by Weſt.

PROPOSITION. XXIIII.

How to know in what part of the firmament any ſtarre is, and how many degrees it is diſtant from the Meridian at any houre: and being right vnder the Meridian, to know how farre it is diſtant from your Zenith.

Hauing rectified the Index of the houre-wheele, by the ſeuenth Propoſition, turne the Globe vntill the Index touch the houre wherein you ſeeke. And ſtaying the Globe there, bring the quadrant of Altitude to the Starre, be it on the Eaſt or Weſt ſide of the Globe, and the nether end of the ſaid quadrant, will ſhew vpon the Horizon among the winds, in what part of the firmament the Starre is: now if you would know how farre the Star is diſtant from the Meridian, do thus. Looke what degree of the Equator is at that inſtant vnder the Meridian, & there make a marke, & then turne the Globe, vntill you haue brought the ſaid Star vnder the brazen Meridian, & marke what degree of the Equinoctial, the ſaid Meridian cutteth at that inſtant: that done, count the degrees contained betwixt the two markes vpon the Equinoctial, for ſo many degrees is the ſtar diſtant at that time frō the Meridian, either towards the Eaſt or Weſt, & by allowing 15. degrees to an houre, & 4'. to a degree, you ſhall know in what time the ſaid Star hath to approach to the Meridian, or how much he is paſt the Meridian, and hauing brought the ſaid ſtar right vnder the Meridian, you ſhal know how farre it is diſtant from your Zenith, by counting the degrees that are contained in the Meridian betwixt

betwixt the ſaid Star and your Zenith. As for example, the firſt of October, 1591. (the Sun being then in the 22. of Libra) I find the Star Cor Leonis, at three of the clocke in the afternoone, to be Weſt Northweſt, and there ſtaying the Globe, I ſée that the Meridian cutteth the Equinoctiall, at the 246. degrees, whereas I make a marke: that done, I bring the Star Cor Leonis to the ſaid Meridian, at which inſtant the Meridian cutteth the Equinoctiall in the 146. degrées, which being taken out of 246. there remaineth 100. degrées, which is his diſtance from the Meridian, which being diuided by 15. I find in the quotient 6. houres, and 40'. for ſo much he is paſt the Meridian towards the Weſt, and by bringing the foreſaid ſtar to the Meridian, I find him to bee diſtant from our Zenith 39. degrées, and 30. minutes.

PROPOSITION. XXV.

How to find the houre of the night by the Globe.

HAuing ſet the Globe at your Latitude, rectifie the Index of the houre-wheele by the eleuenth Propoſition, then hauing taken the Altitude of ſome Starre that you know, and is in the Globe, with your Aſtrolabe or Quadrant, bring the Quadrant of Altitude vnto the Starre, be it in the Eaſt or Weſt, according as you found the Star to be in the firmament, not leauing to turne the Globe, vntill you haue made the Star to haue the like Altitude in the Globe, vpon the Quadrant of Altitude, and alſo the like ſituation that you found it to haue in the firmament by your Aſtrolabe or Quadrant, and ſtaying the Globe there, the Index of the houre-whéele will ſhew the houre: As for example, in the yeare 1590. the firſt of Ianuarie, the Sun being in the 22. of Aquarius, I hauing with my Aſtrolabe found that the Starre, called Canis maior, that is to ſay, the greater Dogge, was eleuated aboue the Horizon, in the Eaſt part of the firmament, 20. degrées, I brought the quadrant of Altitude to the Eaſt ſide of the Globe, not leauing to turne the Globe, vntill I had made the Starre méete euen with the twentie degrée of the quadrant of Altitude, and there ſtaying the Globe, I found by the Index of the houre-whéele, that it was eight of the clocke at night, and a quarter paſt.

PROPOSITION. XXVI.

How to know the Verticall Starres in euery Latitude.

THe Globe and the brazen Zenith, being ſet according to the Latitude of the place where you are, turne the Globe from Eaſt to Weſt, and as many Starres as paſſe right vnder your Zenith, are ſaid to be verticall, as in the Latitude fiftie two you ſhall ſée the taile of the great Beare, the head of Perſeus, and diuers others to paſſe through your Zenith, in turning the Globe from Eaſt to Weſt.

PROPOSITION. XXVII.

How to know the true place of any Starre, that is to ſay, in what ſigne, and in what degree thereof any Starre is.

HAuing faſtned the Semi-circle of Longitude and Latitude, vpon the two Poles of the Zodiaque, the North Pole whereof is in the circle Arctique, not farre from the right claw of the Dragon, and the South Pole thereof is in the Circle Antarctique, right oppoſite to the other, then bring the ſaid Semi-circle to the Starre, whoſe place you ſéeke, and marke therewith what point of the Ecliptique the ſaid Semi-circle cutteth, and that is the place of the ſtar. As for example, by bringing the ſaid Semi-circle to the ſtar called Hircus, that is to ſay, the Goate, I find it to bee in the fiftéene degrée thirtie minutes of Gemini, and that is his place.

PROPOSITION. XXVIII.

How to find the Longitude of any Starre by the Globe.

I Haue told you in my Spheare, that the Longitude of any ſtarre, is that Arch or portion of the Ecliptique line, which is contained betwixt the firſt point of Aries, and that Circle which paſſeth through the Poles of the Zodiaque, and alſo through the bodie of the ſtar, which Circle, the Semi-circle of Longitude and Latitude heere repreſenteth: and by making the ſaid Semi-circle to paſſe through the ſtarre, called Hircus before mentioned, I find that the number of degrees of the Ecliptique, contained betwixt the ſaid Circle, and the firſt point of Aries, to be ſeuentie fiue degrees and 3'0. which is the Longitude of the ſaid ſtar, and thereby maketh his place to bee in the 15. degree 3'0. of Gemini, as before is ſet downe in the laſt Propoſition.

PROPOSITION. XXIX.

How to find out the Latitude of any Starre.

I Told you alſo in my Spheare, that the Latitude is none other thing, but the diſtance of any ſtar from the Ecliptique line either towards the North or South Pole of the Zodiaque, which diſtance the Semi-circle of Longitude and Latitude, made to paſſe through the bodie of the Starre, and cutting the Ecliptique line, doth alwayes ſhew, as in the former example, in making the foreſaid Semi-circle, to paſſe through the foreſaid ſtar called Hircus, I find by counting the degrees of the ſaid Semi-circle, contained betwixt the Ecliptique line and the bodie of the Starre, that the Latitude of that Starre is 22. degrees and 30. minutes towards the North: likewiſe by bringing the ſaid Semi-circle to the ſtarre which

is in the right ſhoulder of Orion, called bed Alguze, I find his Latitude to be ſeuenteene degrees towards the South.

PROPOSITION. XXX.

How to find out by the Globe, the declination of any Star.

THe declination is none other thing, but the diſtance of any Starre from the Equinoctiall, either towards the North Pole or South Pole of the world, which is to be found thus: Firſt, hauing brought the Star right vnder the brazen Meridian, and there ſtaying the Globe, count the degrees of the ſaid Meridian, contained betwixt the ſaid Starre and the Equinoctiall point or ſtreeke of the ſaid Meridian, and that ſhall be the declination of the Starre: as for example, bring the Starre Hircus vnto the Meridian, and you ſhall find the declination thereof to bee fortie fiue degrees towards the North Pole of the world, and that the Starre which is in the foot of the Hare, called Lepus, hath of South declination twentie three degrees.

PROPOSITION. XXXI.

How to know the magnitude or greatneſſe of any Starre, and his nature and qualitie by the Globe, and alſo the right Aſcention of the Arch of the Ecliptique, which accompanieth the right Aſcention of any Starre.

MErcator deſcribeth the ſix magnitudes of the Stars, by making the ſix figures or ſhapes of the Starres, placed not farre from the head of the great Beare, whereof the firſt and greateſt hath 16. points or beames, the ſecond eight, the third ſix, the fourth fiue, the fifth ſix, which indeed by that account would bee but foure: and the ſixth hath fiue, which would haue but thrée: but in mine opinion it had beene better, to haue made the firſt magnitude with tenne points, the ſecond with nine, the third with eight, the fourth with ſeuen, the fift with ſixe, and the ſixt with fiue: ſo ſhould the magnitude of euery ſtar deſcribed in the Globe haue béene the more eaſily knowne. But to the intent that you might exerciſe your ſelfe, in finding out by the Globe, the Place, Longitude, Latitude, and declination of any ſtarre that is deſcribed in the Globe, I haue thought good to adde héereunto the Table of Garceus, ſhewing not onely the Longitude, Latitude, and declination of the moſt notable ſtarres that are both Northward and Southward, but alſo the right aſcention, magnitude or bigneſſe, the qualitie and nature of euery ſuch ſtarre, and alſo the Arch of the Ecliptique line, which accompanieth the right aſcenſion of euerie ſtarre: which Table, though by the ſaid Garceus it was calculated out of the Aſtronomicall Tables, for the yeare of our Lord 1564. and not by the Globe, yet for your better exerciſe in matters of the Globe, I thought good to ſet downe ſuch Longitude, Latitude, declination, magnitude, and right aſcention, and all other things contained in the ſaid Table, according as they are to be found out by the Celeſtiall Globe of Mercator, and not calculated by any of the Aſtronomicall Tables.

Though the Longitudes and declinations of the fixed ſtars, ſet downe in this Table to ſerue Mercator his Globe, doe not altogether agrée with the great celeſtiall Globe, lately ſet forth by Maſter Sanderſon, and by Maſter Molineux, by reaſon that the Longitudes and Declinations of the ſaid ſtarres are more lately calculated, that is to ſay, for the yeare of our Lord 1592. yet it will ſerue to ſhew you the way how to exerciſe your ſelfe in the ſaid Globe, and thereby you may correct this Table, and make it to agrée in all points with the new great Globe, whereby you ſhall reape more pleaſure then griefe or paine. For I had this Table (as I haue ſaid before) out of Garceus, and did héere ſet it downe more for your exerciſe, and to acquaint you with the fixed ſtarres that are deſcribed in the Celeſtial Globe, then for any other purpoſe.

The vſe of the Table next enſuing.

This Table is diuided into eight Collums. The firſt whereof on the left hand contayneth the names of the Starres, the ſecond the degrees and minutes of Longitude, together with the Characters of the twelue ſignes: the third the degrées and minutes of Latitude both Northerne and Southerne, the North Latitude being marked with the letter N. and the South Latitude with the letter S. the fourth contayneth the degrées and minutes of declination both Northerne and Southerne, marked with the letters N. and S. as before. The fift ſheweth the magnitude or greatneſſe of the ſtarre, whether it be of the firſt, ſecond, or third bigneſſe, &c. The ſixth, contayneth the degrees & minutes of the right aſcenſion of the foreſaid fixed ſtarres. The ſeuenth, contayneth the Characters of the Planets, ſignifying the nature & qualitie of the ſtars. The eight contayneth the degrées and minutes of the right aſcenſion of the Ecliptique line and the ſignes of the Zodiaque.

Heere followeth the Table.

The Names of the Starres.	The Longitude and place.	The Signes.	The Latitude.	North & South.	Declination.	Nor. & South.	Magnitude or greatneſſe.	The right aſcenſion. Degr. Min.	The nature of the ſtars ſhewd by the characts of the Planets.	The right aſcenſion of the arch Eclipticke accompanying the ſtar.	The Characts of the Signes.
The firſt ſtar of the Rams Horne.	27 40	♈	7 40	Nor.	17 20	Nor.	3	23 0	♂ ♄	25 0	♈
The right ſhoulder of Cepheus.	8 0	♈	69 0	Nor.	61 0	Nor.	3	217 15	♄ ♃	15 0	♒
The laſt ſtar of Eridanus.	22 30	♈	53 30	Sou.	41 0	Sou.	1	43 30	♃ ♀	15 50	♉
The ſhoulder of Andromeda.	16 20	♈	24 30	Nor.	28 26	Nor.	3	5 0	♀	5 0	♈
The Girdle of Andromeda.	24 50	♈	26 30	Nor.	33 0	Nor.	3	12 10	♀	13 0	♈
The right ſide of Perſeus.	25 0	♉	30 0	Nor.	48 0	Nor.	2	43 0	♄ ♃	19 29	♉
The head of Algol or Meduza.	20 40	♉	23 0	Nor.	39 30	Nor.	2	40 20	♄ ♃	13 0	♉
The South ſtar of Pleiades.	23 29	♉	4 20	Nor.	22 0	Nor.	5	50 18	♂ ☽	23 10	♉
The North ſtar of Pleiades.	23 10	♉	5 0	Nor.	23 10	Nor.	5	50 0	♂ ☽	22 20	♉
The Buls Eye.	2 50	♊	5 0	Sou.	15 30	Nor.	1	63 0	♂	40 20	♊
The right ſhoulder of Orion.	23 0	♊	17 0	Sou.	6 20	Nor.	1	83 20	♂ ☿	23 50	♊
The left ſholder of Orion	12 0	♊	17 0	Sou.	4 40	Nor.	2	72 0	♂ ☿	13 0	♊
The right ſholder of Auriga.	24 0	♊	20 0	Nor.	43 0	Nor.	2	82 82	♂ ☿	22 50	♊
The Goat, or Hircus.	16 0	♊	22 30	Nor.	45 0	Nor.	1	71 30	♂ ☿	13 0	♊
The former of the Kids.	13 0	♊	18 0	Nor.	40 0	Nor.	4	68 50	♂ ☿	10 28	♊
The latter of the Kids.	13 30	♊	18 0	Nor.	39 0	Nor.	4	69 0	♂ ☿	11 0	♊
The left foot of Orion.	10 10	♊	31 30	Sou.	9 40	Sou.	1	73 0	♃ ♄	14 20	♊
The tayle of the little Beare.	21 10	♊	66 0	Nor.	86 0	Nor.	3	4 30	♄ ☿	4 20	♈
The middle ſtarre of Orions Girdle.	18 0	♊	24 30	Sou.	1 50	Sou.	2	79 45	♃ ♄	20 20	♊
Canopus in the ſhip Argo	8 30	♋	75 0	Sou.	52 0	Sou.	1	94 24	♄ ♃	3 30	♋
The great Dogge.	9 0	♋	39 10	Sou.	16 0	Sou.	1	97 0	♂ ♃	6 30	♋
The little Dogge.	20 30	♋	16 0	Sou.	6 10	Nor.	1	109 30	♂	18 0	♋
The former head of Gemini.	14 20	♋	9 40	Nor.	32 0	Nor.	2	106 47	☿	6 0	♋
The following head of Gemini.	17 40	♋	6 30	Nor.	28 30	Nor.	2	110 5	♂	15 28	♋
The North Aſellus.	1 30	♌	3 0	Nor.	22 30	Nor.	4	124 0	♂ ☉	1 40	♌
The South Aſellus in Cancer.	2 20	♌	0 10	Sou.	19 20	Nor.	4	124 50	♂ ☽	2 0	♌
Tracſep, Mang. in Cancer.	1 20	♌	0 40	Nor.	20 0	Nor.	neb.	124 0	♂ ☽	1 30	♌
The ſholder of the great Beare.	11 40	♌	49 0	Nor.	62 30	Nor.	2	161 0	♂	9 30	♍
The bright ſtarre of Hidrus.	21 0	♌	20 30	Sou.	5 0	Sou.	2	137 0	♄ ♂	14 30	♌
The Lions heart,	23 30	♌	0 10	Nor.	13 30	Nor.	1	145 93	♃ ♂	23 30	♌
The Lions necke.	23 10	♌	8 30	Nor.	21 40	Nor.	2	148 40	♄	26 0	♌
The Lions tayle.	15 30	♍	12 0	Nor.	16 20	Nor.	1	171 10	♄ ♀	20 30	♍
The middle ſtarre of the great Beares tayle.	9 50	♍	56 0	Nor.	56 55	Nor.	2	196 0	♂	17 0	♎
The right wing of Virgo.	3 10	♎	15 10	Nor.	12 30	Nor.	3	189 0	♄ ☿	9 40	♎

The Names of the Starres.	The Longitude and place.		The Signes.	The Latitude.		North & South.	Declination.		Nor. & South.	Magnitude or greatneſſe.	The right aſcenſion.		The nature of the ſtars ſhewd by the characts of the Planets.	The right aſcenſion of the arch Eclipticke accompanying the ſtar.		The Characts of the Signes.
											Degr.	Min.				
The left ſhoulder of Bubulcus.	10	0	♎	49	30	Nor.	40	0	Nor.	3	213	0	♄ ☿	5	0	♏
The Rauens Bill.	6	30	♎	21	40	Sou.	23	30	Sou.	3	176	43	♄	26	20	♍
Arcturus the great ſtar betwixt Bubulcus his legs.	18	0	♎	32	0	Nor.	22	0	Nor.	1	209	0	♃ ♂	1	0	♏
Spica Virginis.	17	40	♎	2	0	Sou.	10	0	Sou.	1	195	10	♂ ♀	16	30	♎
The middle ſtarre in the front of Scorpio.	26	40	♏	1	30	Sou.	21	0	Sou.	3	234	0	♂ ♄	26	30	♏
The South Ballance of Libra.	9	0	♏	0	40	Nor.	14	0	Sou.	2	217	0	♄ ♂	9	20	♏
The North ſtarre of the Ballance of Libra.	13	10	♏	9	0	Nor.	8	0	Sou.	2	223	10	♃ ♀	15	46	♏
The left hand of Serpentarius.	72	0	♏	17	0	Nor.	3	30	Sou.	3	238	30	♄ ☿	30	0	♏
The bright ſtar of Ariadnes Crowne.	5	30	♏	44	30	Nor.	28	0	Nor.	2	229	0	♀ ☿	21	20	♏
The hart of the Scorpion.	3	30	♐	3	30	Sou.	25	0	Sou.	2	241	0	♃ ♂	3	0	♐
The head of Hercules.	8	40	♐	37	30	Nor.	15	0	Nor.	3	252	35	☿	14	0	♐
The head of Serpentarius.	15	30	♐	36	0	Sou.	12	50	Nor.	3	258	30	♂ ☿	16	10	♐
The head of the Dragon.	20	20	♐	76	0	Nor.	52	0	Nor.	3	266	10	♄ ♂	26	30	♐
The bright ſtarre of Lyra.	9	0	♑	62	0	Nor.	38	20	Nor.	1	275	20	♀ ☿	5	0	♑
The Eagle, alias Vultur volans.	24	50	♑	29	20	Nor.	7	30	Nor.	2	210	40	♄ ♂	20	4	♑
The firſt ſtar of the tayle of Capricorne.	16	0	♒	2	0	Sou.	18	0	Sou.	3	319	0	♃ ♄	17	0	♒
The following Starre thereof.	17	10	♒	2	0	Sou.	17	30	Sou.	3	320	10	♃ ♄	18	0	♒
The taile of the Dolphin.	8	10	♒	29	30	Nor.	10	0	Nor.	3	204	0	♄ ♂	1	10	♒
The Fomahant.	28	0	♒	23	0	Sou.	33	10	Sou.	1	339	0	♀ ☿	7	0	♓
The point of the Dart.	1	10	♒	39	30	Nor.	18	10	Nor.	4	295	0	♂ ♀	23	8	♑
The taile of the Swanne.	0	20	♓	60	0	Nor.	43	30	Nor.	2	307	10	♂ ☿	5	0	♒
The right thigh of Pegaſus.	22	50	♓	31	0	Nor.	35	0	Nor.	2	341	0	♃ ♂	9	30	♓
The taile of the Whale.	27	0	♓	20	20	Sou.	19	50	Sou.	3	5	35	♄	6	0	♈

PROPOSITION. XXXII.

How to find out the right and oblique aſcenſion of any ſtarre, and alſo the aſcenſionall difference.

The right aſcenſion of any ſtar is an arch or portion of the Equator, to be counted from y^e firſt point of Aries, according to the ſucceſſion of the ſignes, with which portion in a right Spheare any ſtar both riſeth, mounteth to the Meridian, & ſetteth: & in an oblique Spheare it is a portion of the Equator, wherewith the ſtarre is mounted to the Meridian: as for example, in a right Spheare the ſtarre called Cor Leonis, that is to ſay, the heart of y^e Lion, both riſeth, mounteth and ſetteth with the 145. degrée, 3'0. of the Equinoctiall. But the right aſcenſion of the ſaid ſtar in an oblique Spheare, is to bee found onely by bringing the ſaid ſtar to the Meridian, and you ſhall find it to be all one with the right aſcenſion in a right Spheare, for by bringing the ſtar called Cor Leonis to the Meridian in an oblique Spheare, you ſhall finde the right aſcenſion thereof to bee all one with that which it had in a right Spheare, that is, 145. degrées, 3'0. of the Equinoctiall. But if you would know the oblique aſcenſion of any ſtarre, then hauing

uing ſet the Globe at your Latitude, bring the ſtarre to the Eaſt part of the Horizon, and marke what degrée of the Equinoctiall riſeth therwith, and that is the oblique aſcenſion: As for example, the Globe ſtanding at the latitude 52. bring the ſtarre Cor Leonis, to the Eaſt part of the Horizon, & by ſtaying ẏ globe there, you ſhal find the 127. degrée of the Equinoctial to riſe with that ſtarre. Now if you would know the aſcenſional difference, that is to ſay, ẏ difference betwixt the right & oblique aſcenſion, you haue no more to do but to ſubtract the leſſer out of the greater, & the remainder ſhall be the aſcenſionall difference, as in the former example, take 127. degrées out of 145. degrées & 3′0. and there ſhall remaine 18. degrées 3′0. and that is the aſcenſionall difference: by helpe whereof you may know the increaſe and decreaſe of the artificially day & night, throughout the yeere in any Latitude, if you obſerue that order which I haue already ſet downe in the firſt part of my Spheare, the 50. Chapter.

PROPOSITION. XXXIII.

To know in what quantitie of time any whole Signe, or any other Arch of the Ecliptique doth riſe or ſet.

Hauing ſet the Globe at your Latitude, and rectified the Index of the houre-whéele by the ſeuenth Propoſition, bring the beginning of any Arch or ſigne, to the Eaſt part of the Horizon: and marke what degrée of the Equinoctiall riſeth therewith: that done, bring the end of the ſaid ſigne or Arch of the Eaſt part of the Horizon, and marke there alſo what degrée of the Equinoctiall toucheth the Horizon, and ſtaying the Globe there, looke how many houres or parts of houres, the Index of the houre-whéele hath run betwixt the beginning and ending of the ſaid ſigne or Arch, and ſo you ſhall know the quantitie of that time. You may know it alſo by the number of degrées of the Equinoctiall, contained betwixt the beginning and ending of the ſaid ſigne or Arch, by allowing 15. degrées to an houre, and 4′. to a degree. As for example, ſuppoſing the Sunne to be in the firſt degrée of Taurus, you ſhall find by working according to the rule before ſet downe, that the

whole

whole ſigne of Taurus doth ſpend in riſing one houre 8′. Now if you will know how much time he ſpendeth in deſcending, bring the firſt degrée of Taurus to the Weſt part of the Horizon, marking what degrée of the Equinoctiall toucheth the Horizon at that inſtant, & alſo to what houre the Index pointeth, then turne the Globe ſtil Weſtward, untill the laſt degrée of Taurus méeteth euen with the edge of the Horizon, and then marke againe as well the degrées of the Equinoctiall that toucheth the Horizon, as alſo to what houre the Index pointeth, and you ſhall find the number of degrées of the Equinoctiall to be 42. degrées, which maketh two houres 48. minutes, which is anſwerable to the houre of the houre-whéele: and ſo much time the whole ſigne of Taurus ſpendeth in his deſcenſion or going downe.

PROPOSITION. XXXIIII.

How to know by the Globe, what ſtarres doe riſe or ſet euery day Coſmically, Acronically, or Helically.

As for the thrée fold Poeticall riſing and ſetting ſtarres, you ſhall find them plainly defined in the firſt part of my Spheare, Chap. 35. but to find out the ſame by the Globe you muſt doe thus. Firſt hauing ſet your Globe at your Latitude, and ſought out the place of the Sunne for that day, bring the degree of the Sun to the Eaſt part of the Horizon, and ſtay the Globe there, that you may ſee what ſtars do riſe a little before the Sun, and which riſe together with the Sun. For thoſe that riſe a little before the Sun, are ſaid to riſe Helically, and thoſe that riſe together with the Sunne, are ſayd to riſe Coſmically, and thoſe ſtarres that are in the very Weſt part of the Horizon, at the riſing of the Sun, are ſaid to ſet Coſmically. Againe, thoſe ſtarres that riſe immediately after Sun, doe ſet Helically. That done, turne the degree of the Sun unto the Weſt part of the Horizon, & ſtaying the Globe there, marke what ſtarres are ready to go downe with him, for thoſe are ſaid to ſet Acronically, and ſtaying the Globe ſtill there in the Weſt,

marke

marke what ſtarres at that preſent doe riſe in the Eaſt part of the Horizon, for thoſe are ſaid to riſe Acronically.

PROPOSITION. XXXV.

To know in what time of the Yeere any ſtarre riſeth or ſetteth eyther Coſmically, or Acronically.

HEre hauing ſet the Globe at your Latitude, and knowing the degrée of the Sun, bring the ſtarre to the Eaſt part of the Horizon, and therewith conſider what degrée of the Ecliptique the Horizon cutteth at that preſent: that done, finde out the ſelfe-ſame degree vpon the Horizon in the narrow ſpace of degrées next vnto the bodie of the Globe, and right againſt that degree you ſhall finde in what day and moneth that ſtarre doth riſe Coſmically. As for Example, I would know at what time of the yeere, Cor Leonis riſeth Coſmically, in the Latitude 52. I bring the ſtarre Cor Leonis to the Eaſt part of the Horizon, and I find that the Horizon cutteth the Ecliptique in the 23. degree 3′0. of Leo, which degree being found againe vpon the Horizon, pointeth to the firſt day of Auguſt, ſo as I conclude that Cor Leonis doth riſe that preſent day Coſmically, for then both hee and the Sunne are in a manner in one ſelfe degree of the Ecliptique: now to know the Coſmicall ſetting of the ſaid ſtarre, turne the ſame ſtarre to the Weſt part of the Horizon, and marke what degree of the Ecliptique doth then riſe in the Eaſt, and you ſhall finde the ſame to bee the 23. degree of Aquarius, which degree being found againe vpon the Horizon in the narrow ſpace of degrees next to the bodie of the Globe, contayning the degrees of the Zodiaque, will point to the 31. day of Ianuarie, at which time the Sunne is oppoſite to the ſaid ſtarre, and therefore it is ſaid to goe downe Coſmically, becauſe it goeth downe when the Sunne riſeth. Now to know the Acronical riſing of any ſtar at any time, bring the ſtarre to the Eaſt part of the Horizon, and marke therewith what degree of the Ecliptique goeth downe in the Weſt at that inſtant, for the Sun being in that degree is oppoſite to the ſtar: As for example, by bringing the ſtar Cor Leonis to the Eaſt part of the Horizon, you ſhall find that the twentie thrée degrée of Aquarius goeth downe at that inſtant, which degrée being found againe vpon the Horizon, will ſhew the day and moneth when the ſtarre riſeth Acronically, and ſo you ſhall find the ſtarre Cor Leonis to riſe Acronically, the thirtie one day of Ianuarie. Contrariwiſe, if you would know when the ſaid ſtarre ſetteth Acronically, bring the ſaid ſtar Cor Leonis to the Weſt part of the Horizon, and therewith marke what degrée of the Ecliptique then ſetteth in the Weſt, which degrée being found againe vpon the Horizon, will ſhew that the ſaid ſtarre ſetteth Acronically the firſt of Auguſt.

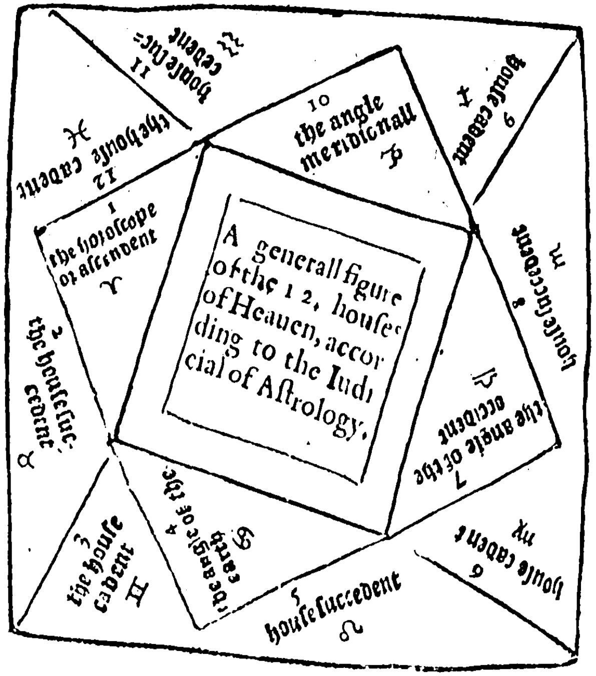
PROPOSITION. XXXVI.

Of the Horoſcope, and the reſt of the twelue houſes.

THis word Horoſcope, doth not onely ſignifie the degrée of the Ecliptique, otherwiſe called the aſcendent, which riſeth aboue the Horizon in the beginning of any thing that is to be ſought or knowne, but alſo ſometimes the whole figure of heauen, containing the twelue houſes, & doth ſhew the verie ſecrets of nature, ſo that there is nothing that chanceth to the inferiour bodies, but ſome cauſe thereof doth appeare by meanes of the Horoſcope in heauen, & therefore the Aſtrologians haue diuided the whole heauen into twelue houſes, which are numbred from the Horoſcope, which is the Eaſt Angle, and ſo forth, according to the ſucceſſion of the ſignes, of which twelue houſes, the foure principall are foure points of the Zodiaque, whereof two doe fall vpon the Horizon, and the other two vpon the Meridian, and are called principal points, Poles, or Angles, that is the beginning of the firſt houſe, of the fourth houſe, of the ſeuenth houſe, and of the tenth houſe, and thoſe that doe follow next any of theſe principall Angles, are called ſuccéeding houſes, in Latine Succedentes, as the ſecond, the fifth, the eight and eleuenth houſe. And thoſe that goe next before any of the foure principall Angles, are called falling houſes, in Latine Cadentes, as the twelue, the third, the ſixth, and the ninth: and ſuch houſes as haue no familiaritie with the Horoſcope, or Aſcendent,

Aſcendent, as the ſecond, the ſixth, the eight, and the eleuenth houſes are ſaid to bee ſlow and delect, all which things this Table héere following doth ſhew, containing the number and names of the houſes, and alſo their ſignifications.

The 12. houſes.	The names of the houſes.		The ſignifications of the houſes.
1	Angle	Eaſt	life
2	ſucceeding	the lower gate	gaine
3	falling	the Godeſſe	brethren
4	Angle	the bottom of Heauen	parents
5	ſucceeding	good fortune	children
6	falling	euill fortune	health
7	Angle	the Weſt	wife
8	ſucceeding	the higher gate	death
9	falling	God	religion
10	Angle	the middle of heauen	kingdome
11	ſucceeding	the good ſpirit	benefactor
12	falling	the euill ſpirit	priſon


A generall figure of the 12. houſes of Heauen, according to the Iudicial of Aſtrology.
1 the horoſcope or aſcendent ♈
2 the houſe ſuccedent ♉
3 the houſe cadent ♊
4 the angle of the earth ♋
5 houſe ſuccedent ♌
6 houſe cadent ♍
7 the angle of the occident ♎
8 houſe ſuccedent ♏
9 houſe cadent ♐
10 the angle meridionall ♑
11 houſe ſuccedent ♒
12 the houſe cadent ♓

PROPOSITION. XXXVII.

How to find out the Horoſcope or Aſcendent, at any time of the day or night by the Globe, and thereby to know the foure principall Angels of Heauen.

First, hauing ſet the Globe at your Latitude, and rectified the Index of the houre-whéele, according to the degrée of the ſigne wherein the Sun is that day you ſéeke, by the 7. propoſition if it be in the day time, take with your Aſtrolabe or Quadrant the Altitude of the Sun. But if it be in the night, take the Altitude of ſome knowne ſtar, that therby you may know the houre of the day or night, in which you ſéeke the aſcendent. But if it happen that neither Sun nor Starre, is to be ſéene that day or night, then learne by ſome true clocke or watch what houre it is, and hauing ſet the Index of the houre-whéele at that houre, ſtay the Globe there, & therewith marke what degrée of the Ecliptique riſeth in the Eaſt part of the Globe, aboue the Horizon at that inſtant, and that degrée is the Horoſcope or Aſcendent for that houre. As for example, you would find out the Aſcendent the 16. of Iune 1590. at 8. of the clocke in the forenoone, at which day the ſun is in the fourth degrée of Cancer: héere hauing firſt ſet the Index of the houre-whéele at that houre, by ſtaying the Globe there, you ſhall find that the 21. degrée 3'0. of Leo is the Aſcendent, which is the Eaſt angle or firſt houſe, whereby you may alſo at that inſtant find out the other thrée angles, that is the Weſt, South, and North angles: for the oppoſite point of the Zodiaque to the Aſcendent, is the Weſt angle or 7. houſe. And that degrée of the Zodiaque, which is at that inſtant right vnder the Meridian, aboue head is the South angle or 10. houſe, & the oppoſite point to that beneath, is the North angle or fourth houſe, for hauing found the Aſcendent, which is the Eaſt angle or firſt houſe, to be the 21. degrée 30. minutes of Leo, the Weſt angle muſt néeds be the 21. degrée 30. minutes of Aquarius. Againe, the South angle or 10. houſe, is the 8. degrée of Taurus, and the oppoſite

poſite point that is is the North Angle, or fourth houſe which is the ſeuenth of Scorpio.

PROPOSITION. XXXVIII.

How to erect a Figure by the Globe, according to Regio Montanus *his way, which is called the reaſonable way, and is counted the beſt of all others.*

FIrſt, you muſt find out the degree of the Aſcendent, as is taught in the laſt Chapter, which is alwayes the firſt houſe, then ſtaying the Globe with ſome prettie wedges of wood, being thruſt betwixt the Horizon and the body of the Globe, marke there what degree of the Equinoctiall doth touch the Horizon at that inſtant, and number from thence vpward vpon the ſaid Equinoctiall thirtie degrées, to the end of which thirtie degrées, bring the Semi-circle of poſition, being firſt faſtned in his due place vpon the Eaſt ſide of the Horizon, and looke what degree and ſigne of the Zodiaque the circle of poſition cutteth at that preſent, and that degrée ſhall be the twelfth houſe: then number againe other thirtie degrées vpon the Equinoctiall vpwards towards the brazen Meridian, and to that bring the Semi-circle of poſition, marking what degrée of the Zodiaque, the ſaid Semi-circle cutteth, and that ſhall bee the eleuenth houſe, that done, looke what degree of the Zodiaque is right vnder the brazen Meridian aboue head, and that ſhall bee the tenth houſe. Then hauing ſet the Semi-circle of poſition vpon the Weſt ſide of the Globe, number from the brazen Meridian Weſtward, vpon the Equinoctiall other thirtie degrees, to the end whereof bring the Semicircle of poſition, and marke what degrée of the Zodiaque the Circle of poſition cutteth, and that ſhall bee the ninth houſe, then from thence downeward number vpon the Equinoctiall other thirtie degrees, to the end whereof bring the Semi-circle of poſition, marking there what ſigne and degree of the Zodiaque the ſaid Semi-circle cutteth, and that ſhall

ſhalbe in the eight houſe. Now hauing theſe ſix houſes, the oppoſite points of the ſaid ſixe houſes will ſhew you the other ſixe houſes, and if you will know which houſes, & alſo which ſignes are oppoſite one to another, marke well this Table following.

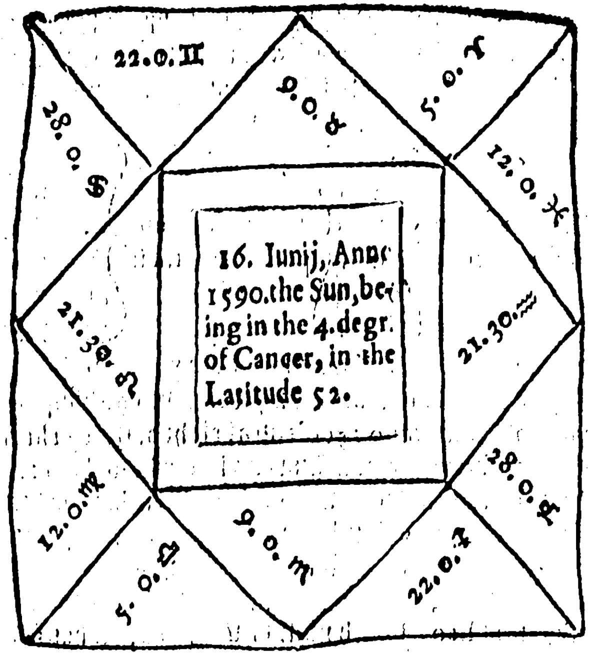
The houſes oppoſite are theſe,

1	to	7
12		6
11		5
10		4
9		3
8		2

The Signes oppoſite are theſe

♈	to	♎
♉		♏
♊		♐
♋		♑
♌		♒
♍		♓

And to make all theſe things the more plaine vnto you, I thought good to ſet downe this example following. Suppoſe that the ſixtéene of Iune, Anno 1590. and at eight of the clocke in the morning, you would erect a figure, to know how the 12. houſes of heauen are ſituated at that preſent. Firſt, hauing drawne ſuch a ſquare figure as this héere following, repreſenting the twelue houſes, learne by the laſt propoſition, who is that aſcendent at that inſtant, and you ſhall find it to bee the twentie one degrée thirtie of Leo, which muſt be ſet in the firſt houſe, and the twentie eight degrée of Cancer in the twelfth houſe, and the 22. degrée of Gemini in the eleuenth houſe, & the ninth degrée of Taurus in the tenth houſe, and the fifth degrée of Aries to be in the ninth houſe, & the twelfth degrée of Piſces in the eight houſe. Now the oppoſite houſe, to the firſt houſe or aſcendent, is the ſeuenth houſe, which is the twentie one degrée 3'0. of Aquarius, for the oppoſite ſigne muſt alwaies haue like number of degrées: then the oppoſite to the twelfth houſe, is the ſixth houſe, which is the twenty eight degrée of Capricorne, & the oppoſite to the 11. is the fifth houſe, which is the twenty two degrée of Sagittarius, and the oppoſite to the tenth houſe is the fourth houſe, which is the ninth degrée of Scorpio, & the oppoſite to the ninth houſe is the third houſe, which is the fifth degrée of Libra, and the oppoſite to the eight houſe, is the ſecond houſe which is the twelfth degrée of Virgo, all which things this figure héere following doth plainely ſhew. And if you would know what Planets ſhould be placed in euerie houſe, you muſt learne that out of the Ephemerides, or out of ſome of the Aſtronomicall tables.


22.0.♊
9.0.♉
5.0.♈
28.0.♋
12.0.♓
21.30.♌
16. Iunij, Anno 1590. the Sun, being in the 4. degr. of Cancer, in the Latitude 52.
21.30.♒
12.0.♍
28.0.♑
5.0.♎
9.0.♏
22.0.♐

Now becauſe moſt men that doe ſhew the vſe of the Globes, do alſo teach therein how to find out the Latitude & Longitude of any region, I thought good therefore to ſet downe here ſome of their manifold waies, touching the finding out of the ſame, notwithſtanding, that I haue already written ſomething thereof in the ſecond part of my Spheare, in the 8.9.10.& 11. Chapters.

Proposition. XXXIX.

How to know the Latitude of any place or region, by any of the fixed Starres deſcribed in the Globe.

Take in the night ſeaſon with your Aſtrolobe, the Meridian Altitude of ſome knowne Starre that is to be found in the Globe, then hauing brought the ſtarre vnder the brazen Meridian, turne the Meridian vp and downe in the nickes of the Horizon,

vntill the ſame Starre haue the ſaid Altitude in the brazen Meridian, which you found it to haue in the firmament by your Aſtrolabe: that done, number the degrees of the Meridian, contained betwixt the Pole and the Horizon, and that is the Latitude of that place.

Proposition. XL.

Another way to find the eleuation of the Pole.

Hauing brought the Globe into an open place, where the Sun ſhineth at noonetide, and placed the ſame right North and South, as is taught in the firſt chapter, ſet a néedle in the degrée of the Sunne, and bring the ſame to the brazen Meridian, not leauing to turne the ſame Meridian vp and downe in the nickes of the Horizon, vntill the needle caſt no ſhadow at all, and there ſtaying the Globe, looke how many degrees the Pole is eleuated aboue the Horizon, for that is the Latitude of that place.

Proposition. XLI.

A third way to find out the Latitude of any place, without taking the Meridian Altitude of any Starre.

Take at any houre the Altitude of two knowne ſtars, and ſuch as are to be found in the Globe at one ſelfe inſtant, whereof the one muſt bee ſituated towards the Eaſt, & the other towards the Weſt, then turne the Globe together with the Meridian vp and downe in the nicks of the Horizon, vntill you find by helpe of the quadrant of Altitude, each ſtarre to haue the ſelfe ſame Altitude in the Globe, that it had in heauen, which being done, looke how many degrees the North Pole is eleuated aboue the Horizon, and that is the Latitude of that place. But if you would know the Latitude of any place that is towards the South pole, then you muſt firſt place the South Pole aboue the Horizon, and then worke as before.

PROPOSITION. XLII.

A fourth way to find out the Latitude of any Region, by any knowne fixed Starre or Planet that may be ſeene.

FIrſt, take his Meridian Altitude, and then learne to know either by the Globe, or by ſome Table his Declination, which if it be Northerne, you muſt ſubſtract the ſame from the Meridian Altitude, if Southerne, adde it to the Meridian Altitude, ſo ſhall you haue the eleuation of the Equinoctiall, which being ſubtracted from nintie, the remainder ſhall be the Latitude of that place; as for example, I find the Meridian Altitude of Oculus Tauri to be fiftie thrée degrées 50'. 32". and his declination Northward to be fifteene degrées 50'. 32". which declination being ſubſtracted from the Meridian Altitude, there remaineth thirtie eight degrées, and that is the eleuation of the Equinoctiall, which being ſubſtracted from nintie, there remaineth fiftie two for the Latitude of that place.

Hitherto, I haue ſet downe the chiefeſt propoſitions that are to be done by the Globe, touching the Sun and the fixed Stars, and laſtly, ſhewed how to find out the Latitude of any place: wherefore now I thinke good to ſhew you how to find out the place of the Moone, & of euery one of the reſt of the planets in the Globe, by helpe of the Ephemerides, and thereby to know when euerie Planet riſeth and ſetteth: and firſt of the Moone.

PROPOSITION. XLIII.

A briefe deſcription of the diurnall Table, ſet downe in Stadius *his Ephemerides, together with the vſe thereof.*

BUt for as much as the diurnall Table of the Ephemerides, ſhewing the daily motion of the Planets, is verie néedfull to ſerue diuers turnes, I thinke it not amiſſe heere briefly to deſcribe the ſame, and ſpecially that of Ioannes Stadius, whoſe diurnall Table or Almanacke, beginning at the two hundreth and ſecond page of his booke, and at the yeare of our Lord 1583. continueth to the yeare 1606.

Of which Table, euerie page on the left hand is diuided into nine collums. In the firſt collum whereof on the left hand are ſet downe the daies of the moneth, firſt the Gregorian daies, according to the Romane account, & next to that the daies of the moneth, according to our Engliſh account, then in the front of euery other collum, are ſet downe the characters firſt of the ſun, and then of the other ſix Planets, that is to ſay, of the Moone, Saturne, Iupiter, Mars, Venus, Mercurie, & laſt of all the head of the Dragon figured thus ☊. And right vnder theſe ſeuen Planets, and alſo vnder the head of the Dragon, are ſet downe the ſignes and degrées, wherein euery of theſe is euerie day of the moneth, throughout the yeare at noonetide, & in the foote of the ſaid Table, is ſet downe the Latitude of euery one of the fiue Planets, procéeding by the daies of the moneth, diuided into thrée parts. And in the margent of euery left page, are ſet downe the chiefeſt feaſts and Saints daies, that fall in euery moneth throughout the yeare. Moreouer, there is a Table on the right hand, right againſt the left Table, in which are ſet downe firſt the daies of the moneth, and then what coniunction, or any other aſpect the Moone hath with any of the other ſixe Planets, that is, with the Sunne, with Saturne, with Iupiter, with Mars, with Venus, and with Mercurie, which Planets are ſet downe in the front of the ſaid Table, and vnder them the Characters of ſuch aſpects, as the Moone hath that day with any of the other Planets. The Characters of ſuch aſpects are theſe héere following.

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Whereof, the firſt ſignifieth a coniunction, the ſecond, an oppoſition, the third, a trine aſpect, the fourth, a quadrat aſpect, and the fift, a ſextile aſpect.

Two Planets are ſaid to be in a coniunction, when they are both in one ſelfe ſigne. And to be in an oppoſition, when they are in two ſeuerall ſignes oppoſite one to another. For then they be diſtant one from another ſixe ſignes. And they are ſaid to bee in trine aſpect, when they be diſtant one from another by foure ſignes. And to bee in a quadrat aſpect, when they are diſtant one from another by thrée ſignes. And to be in a ſextile aſpect, when they are diſtant but two ſignes one from another.

PROPOSITION. XLIIII.

How to find out the place of any Planet by the Ephemerides.

HOw to find out the place of any Planet, or of the head of the Dragon by this diurnall Table, you muſt firſt ſéeke out the day of the moneth in the firſt collum of the left Table, right againſt that on your right hand in the ſaid left Table, you ſhall find in the common Angle right vnder the Planet or Dragons head, (which ſoeuer of them you ſéeke) the ſigne and degree wherein the ſaid Planet or Dragons head is the ſaid day at noonetide.

And to find out the aſpects which the Moone hath with any of the Planets the ſame day, you muſt reſort to the other Table on the right hand, obſeruing like order as before.

The Example.

As for example: the twentie one of Aprill 1592. which is the firſt of May, according to the Romane account, I find by the Table on the left hand, the Sun to be in the tenth degrée 5'0. of Taurus, the Moone to be in the third degrée 4'7. of Capricorne, Saturne to be in the eight degrée 1'0. of Cancer, Iupiter to bee in the eightéene degrée 2'8. of Sagittarius, Mars to be in the twelfth degrée 6', of Genini, Venus to be in the ſecond degrée 0'. of Aries, and Mercurie to be in the ſixth degrée 2'0. of Taurus, & the head of the Dragon to be in the twentie nine degrée 4'5. of Gemini.

And right againſt this in the Table on the right hand, you ſhall find the Moone to bee in a trine aſpect with the Sunne, to bee in an oppoſition with Saturne, to bee in a trine aſpect with Mercurie.

Thus hauing briefly ſhewed the vſe of the diurnall Table, I wil ſhew you now how to find out the Latitude of the Moone as well North as South, by helpe of Stadius his Table, ſet downe in the one hundred and twelue page of his Ephemerides, and firſt I will briefly deſcribe the ſaid Table.

PROPOSITION. XLV.

A briefe deſcription of the Table of Stadius *ſet downe in the one hundred and twelfth page of his Ephimerides, to find out thereby the daily Latitude of the Moone, bee it North or South, together with the Canon or Rule thereof plainely declared by example.*

THis Table is diuided into eight collums, whereof the firſt on the left hand, containeth the degrees of euery ſigne ſet downe in the front of the Table, which degrees are to be counted deſcending from one to thirtie, for ſo many degrees there be in euerie ſigne: and the laſt collum on the right hand, containeth the like number of degrees, belonging to the ſignes ſet downe in the baſe or foote of the ſaid Table, and this number aſcendeth vpward from one to thirtie, and for that purpoſe, it would not haue beene amiſſe to haue ſet ouer each head of thoſe two collums this word Gradus, next vnder the word Signa. And of the other ſixe collums, the firſt thrée on the left hand doe containe the degrees, minutes, and ſeconds of the North Latitude, and the other thrée towards the right hand doe containe the degrees, minutes, and ſeconds of South Latitude. Moreouer, the twelue ſignes are to be numbred in the front, from the third collum on the left hand, from one to fiue forward toward the right hand, and at the foot from ſixe to a eleuen backeward toward the left hand, ſet downe in Arithmeticall figures.

The Rule or Canon, together with a plaine example, ſhewing the vſe of the Table.

FIrſt, knowing the day of the moneth, reſort vnto the diurnal Table of motion of the Planets in the Ephemerides, & hauing there found out the motion or place of the Moone, and alſo of the Dragons head, anſwerable to the day wherein you ſeeke, ſubſtract the place of the Dragons head from the place of the Moone, which is eaſily done ſo often as the Arch of the Moone is greater, that is to ſay, containeth more ſignes & degrees than the Arch of the Dragons head, beginning your account in both Arches from the firſt point of Aries. But if the Arch of the Moone bee leſſe then the Arch of the Dragons head, ſo as you cannot make your ſubſtraction, then you muſt adde to the place of the Moone twelue ſignes, which is *360.* degrees, and you muſt adde alſo thereunto the number of ſo many ſignes, as are contained betwixt the firſt point of Aries, and the firſt point of that ſigne wherein the Moone is at that preſent, which ſigne it ſelfe is not to be numbred, and when you can take out of that whole ſumme, the place of the Dragons head, you muſt firſt adde to the ſaid place of the Dragons head, the number of ſo many ſignes as are contained betwixt the firſt point of Aries, and the firſt point of that ſigne wherein the Dragons head is at that inſtant, but not the ſigne wherein it is, and then hauing made your ſubſtraction, remember alwaies to take out of that remainder ninetie degrees, which is three ſignes, ſo oft as you haue need to adde twelue ſignes to the place of the Moone, and not otherwiſe, and with that remainder, you muſt reſort to the foreſaid Table of the Moones Latitude, as for example.

The Example.

Suppoſe, that you would know what Latitude the Moone had the firſt of Nouember 1590. here reſorting to the diurnall Table of the Ephemerides, you find according to the day propounded, the place of the Moone to be in the ſixteen degree 4′9 of Taurus, and the place of the Dragons head to be in the twentie eight degree 1′4. of Cancer. Now, according to the rule before giuen, you muſt take the place of the Dragon here, which is twentie eight degrees 1′4. of Cancer, out of the 16. degree 4′9. of Taurus, which is the place of the Moone, & becauſe you cannot take the greater ſum out of the leſſer, you muſt adde to the leſſer ſum twelue ſignes, which make three hundred ſixtie degrees, and alſo one ſigne, for Aries going next before Taurus, in which ſigne the Moone is, ſo ſhall you make the whole ſum to be thirteene ſignes, ſixteene degrees 4′9. out of which ſumme you muſt ſubſtract the dragons head, which with the ſignes that goe next before Cancer, counting from the firſt point of Aries, doe make three ſignes 28. degrees 1′4. which being ſubſtracted out of 13. ſignes, 16. degrees 4′9. there remaineth 9. ſignes, 18. degrees, 3′5. out of which you muſt alſo ſubſtract 90. degrees, which is three whole ſignes, & ſo you find the remainder to be ſixe ſignes, eighteene degrees 3′5. with which laſt remainder, you haue to enter into the Table of the Moones Latitude, in the foot wherof you ſhall find ſixe ſignes, and in the laſt collum on the rigt hand eighteene, and in the next collum towards the left hand, & in the common Angle anſwerable as wel to the ſaid eighteene degree, as alſo to the ſix ſignes, you ſhall find the Latitude of the Moone to be foure degrees 4′5. and 17″. (which ſeconds may be verie well omitted) and her Latitude to be South. But now becauſe there are 3′5. more annexed to eighteene degrees of the foreſaid remainder; you muſt find out a proportionall part, anſwerable to thoſe minutes, which is to be done thus.

Take out of the Table, the whole Latitude anſwerable to ſix ſignes and nineteene degrees, which is one degree more, ſo as now the Latitude of the Moone is foure degrees, 4′3. omitting the ſecond. Then ſubtract foure degrees 4′3. out of foure degrees 4′5. and there remaineth 2′. Now, to find out a proportionall part anſwerable to the former 3′5. you muſt ſay thus. If 6′0. require 2′. what ſhall 3′5. require? and the quotient yeeldeth 1′. 1″0. which being ſubſtracted out of foure degrees 4′5. there will remaine foure degrees 4′4. and ſo much was the South Latitude of the Moone at that preſent day.

How

PROPOSITION. XLVI.

How to know the true place of the Sun or Moone, or of any other Planet euerie houre of the day throughout the yeare.

BUt now becauſe that to find out the true place of the Moone, or of any other Planet in the Globe, to worke thereby certainely and truely, it is not enough to know the places in the Zodiaque at noonetide, vnleſſe you know the ſame at the very houre in which you ſéeke. Stadius teacheth a briefe rule to find out the true place of any Planet at what houre ſoeuer you deſire, by helpe of a ſhort Table ſet downe in the one hundred and ninth page of his Ephemerides, which Rule and Table he borrowed of Reinholdus. And this Table conſiſteth of thrée collums, in euery front whereof are ſet firſt degrées, minutes, ſeconds and thirds, and vnder them minutes, ſeconds, thirds, and fourths. And note, that the firſt row of numbers on the left hand, ſignifieth ſometimes degrées, and ſometimes minutes, either of which doe extend in this Table to ſixtie, and to ſixtie one, right againſt which row in euerie collum is ſet downe on the right hand, the proportionall part for one houre, the Rule is thus.

The Rule.

Firſt, find out by the Ephemerides the place of the Planet, wherein it is at noonetide the ſame day that you ſéeke, and alſo the place of the ſame Planet, wherein it is the next day following at noone, and ſubſtract the leſſer out of the greater, if the two places at noonetide be ſtill in one ſelfe ſigne, but if the two places be in two ſeuerall ſignes, then you muſt count how many degrées of the Ecliptique, the one place is diſtant from the other, and that ſhall be the difference, with which difference, you muſt reſort to the Table, and right againſt that on the right hand in the ſame collum wherein you found the difference, you ſhall alſo find the proportionall part for one houre, as by this example you ſhall more plainely vnderſtand.

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The Example.

Suppoſe then, that you deſire to know the true place of the Sunne or of the Moone, or of any other Planet at fiue of the clocke in the afternoone, the thirtieth of December 1591. at which day you ſhall find the Sunne at noonetide to bee in the eightéene degrée, and ſeuen minutes of Capricorne, and the next day at noone to bee in the ninteene degrée and 8′. of the ſame ſigne, the difference whereof you find by ſubſtraction, to bee one degrée and one minute, with which difference you muſt enter into the Table, & ſéeking for one degrée in the firſt collum on the left hand, you find next vnto that on the right hand 2′. 30″. then for one minute which before was named one degrée, you find next vnto it 2′. 30‴. which being added to the former ſum laſt found, maketh 2′. 32″. 30‴. which is the proportionall part for one houre. Then hauing multiplied that by fiue houres to ſerue fiue of the clocke in the afternoone, you ſhall find the product to be 12′. 42″. 30‴. which being added to the firſt Meridian place, which is eightéene degrées and ſeuen minutes of Capricorne, maketh alſo eightéene degrées 1′9. 42″. 30‴. And remember, that if your difference be onely minutes, then the bodie of the Table doth ſhew the proportionall part. But if the difference doth containe degrées, then the fourths muſt bee made thirds, and the thirds ſeconds, the ſeconds minutes, and the minutes degrées. And this Table ſerueth for the ſeuen Planets for euer. Notwithſtanding, Stadius ſetteth downe another Table to find out thereby the proportionall mouing of the Moone, ſeruing as well for houres, as for minutes of houres. Which Table beginneth at the one hundred fortie fourth page, and endeth at the one hundred eightie fourth page of his booke.

In the front of which Table in euery page, are ſet downe the differences of the two places of the Planets, which you haue found by ſubſtracting the leſſer out of the greater, if the Planet bee at both noonetides in one ſelfe ſigne, but if ſhee bee at the two noonetides in two ſeuerall ſignes, then ſuch difference is to bee accounted vpon the Ecliptique line, to know how many degrées the one place is diſtant from the other: and

as

as for the minutes, if there be any, you may know the difference thereof, by ſubſtracting the leſſer number out of the greater. And in the outtermoſt collum on the left hand, are ſet downe the houres and minutes, marked in the foote with the letter H. ſignifying houres, and vnder that with the letter M. ſignifying minutes, whereof the houres procéed but to 24. but the minutes extend to 60. which make one houre procéeding by euen numbers in this ſort. 1. 2. 4. 6. 8. &c. and therefore not finding that houre or minute, which you ſéeke in the ſaid collum, you muſt take the next number which is leſſer by one, and ſo make it vp by adding the firſt, and onely adde one vnto it, and in each common angle, you ſhall find the Proportionall part, that is to bee added to the firſt place of the Planet, anſwering to the day of the moneth wherein you ſought. All which things you ſhall more plainely vnderſtand by this one example.

The Example.

Suppoſe then, that you would know the true place of the Moone at fiue of the clocke. 1′7. in the afternoone the twentie eight of December 1591. and looking in the Ephemerides, you find the place of the Moone to bee the ſame day at noonetide, in the twentie ſixe degrée, 1′2. of Libra, & the next day at noonetide to be in the eight degrée. 1′7. of Scorpio, here by numbring how many degrées are contained in the Ecliptique line, betwixt thoſe two places, and by ſubſtracting the leſſer number of minutes out of the greater, you ſhall find the difference to bee twelue degrées 5′. with which difference you muſt reſort to the Table of proportionall parts, and there hauing found the ſaid difference, in the front of the thirtéene page of the ſaid Table, looke in the firſt collum, on the left hand, for houres and minutes, according to the rule before ſet downe. As héere in this example, becauſe you cannot find fiue houres, you take foure, right againſt which, on the right hand in the common angle, you ſhall find two degrees 0′. 50″. then for one houre to make the fiue houres, you ſhall find in the common angle 3′0. 12″. that done, ſeeke out the 1′7. in the firſt collum, which number not being there, you muſt take ſixteene, againſt which in the common angle, you ſhall find 8′.3″.23‴. and

for

for the one minute which is to be added ſixtéene, you ſhall find in the common angle againſt that one minute 30″. 12″. and by adding all theſe ſums together, you ſhall find the proportionall part to be twelue degrées 39′. 35″. 32‴. which being added to the place of the Moone at noonetide firſt found in the Ephemerides; maketh in all 28. degrées 51′. 35″. 32‴. of Libra, which is the true place of the Moone for that houre. But you haue to note, that the denominations of the numbers contained in the common Angles of proportionall parts be not alwayes like, for when they are to anſwere houres, then the firſt number on the left hand in euery Angle ſignifies degrées, and the reſt minutes and ſeconds, but if they haue to anſwere minutes of houres, then the firſt numbers do ſignifie minutes, and the reſt ſeconds and thirds, as you may eaſily perceiue by examining the former example. But now to returne to my firſt intention, which was to ſhew you how to find out the true place of euerie Planet in the Globe, you haue to vnderſtand, that hauing found out the true place of any Planet, at the day and houre wherein you ſeeke by ſuch meanes as is before taught, then reſort to the Celeſtiall Globe, and hauing ſet the ſame at your Latitude, and alſo rectified the houre-whéele, according to the day wherein you ſeeke: Suppoſe that the 26. of May 1592. you would know in what part of the Globe the Moone is to be found at fiue of the cloke in the afternoone. Here firſt, you muſt know her place at noone the ſame day, which is the 14. degrée 28′. of Aries, & alſo her place the next day at noone, which is the 29. degrée 0′. of the ſame ſigne: Now by taking 14. degrées 28′. out of 29. degrées, you ſhall find the remainder to be 14. degrées 32′. with which difference, you muſt reſort to the Table ſet downe in the 109. page. And by working as before is taught, you ſhall find her place or Longitude to be at fiue of the clocke in the 17. degrée 23″.6′.43‴. of Aries, which being counted vpon the Ecliptique line of the Globe, lay your Semi-circle of longitude and Latitude to that point, and hauing learned her latitude by helpe of the Table of latitude before mentioned, by which you ſhall find her latitude to be at that time 4. degrées 46′. to the Southward, then hauing counted that latitude vpon the Semi-circle of longitude & latitude,

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tude, make there a marke vpon the Globe, for that is her verie place at that inſtant, that is to ſay, at fiue of the clocke in the afternoone the twentie ſix day of May 1592.

Now if you would know when ſhee riſeth and ſetteth, you haue no more to do, but to bring her place before marked on the Globe vnto the Horizon on the Eaſt part, and the Index of the houre-wheele being rectified, as is before ſaid, will ſhew the hour of her riſing aboue the Horizon, and by bringing her place to the Weſt part of the Horizon, the Index will ſhew the houre of her ſetting, & by bringing her place to the brazen Meridian, you ſhall know at what houre ſhe is full South. The like Tables you ſhall find alſo in Stadius, to find out the true place of euery other Planet at any houre, as of Saturne, Iupiter, Mars, Venus and Mercurie, which Tables doe begin at the 128. page, and end at the 143. page of his booke, the order of working by which Tables is like in euery reſpect vnto that of the Moone laſt taught: by which Tables you may find out the true place of any other Planet in the Globe at any houre of the day or night, and thereby to know the houre of his riſing and ſetting, if you rightly obſerue the Rules before taught, touching the vſe of the foreſaid Tables. And note that you may find out the place of the Moone, by the Globe without the helpe of any Ephmerides, by ſuch wayes as here doe follow.

PROPOSITION. XLVII.

How to find out the place of the Moone by the Globe, when ſhee is aboue the Horizon, without the helpe of any Ephemerides or other Table whatſoeuer.

Hauing ſet the Globe at your Latitude, and placed it ſo as it may rightly anſwere the foure quarters of the World, take the altitude of the Moon with your Aſtrolabe or quadrant, & marke therewith whether ſhee be at that preſent Eaſt or Weſt, that is to ſay, on the Eaſt ſide of the Meridian, or paſt the Meridian: that done, take the altitude of ſome fixed ſtar, which you know, and is to be found

in the Globe, and alſo at that time, is aboue the Horizon, marking therewith in what part of the firmament. the ſaid ſtar is, and with your croſſe-ſtaffe take the diſtance betwixt the Moone and that ſtarre. Then hauing theſe three things, that is, the Altitude of the Moone, and the Altitude of the ſtarre, and alſo the diſtance betwixt the Moone the knowne ſtarre; Mooue the Globe together with the quadrant of Altitude too and fro, vntill you haue made the Moone to haue the ſame Altitude and like place in the Globe, that you found it to haue in the firmament, and there make a marke vpon the Globe. Then bring the quadrant of Altitude towards the Starre, that the Star may haue the like Altitude and like place in the Globe, that it had in the firmament, and there hauing ſtaied the Globe that it may not mooue, take with your Compaſſe vpon the Equinoctiall, the diſtance betwixt the Moone and the Starre before found by the croſſe-ſtaffe, and keeping your Compaſſes at that wideneſſe, put the firme foot of your Compaſſes in the fixed Starre, and ceaſe not to mooue the other foot together with the quadrant of Altitude, towards the marke of the Moones Altitude, vntill you make them to meet, for there is the place of the Moonr.

PROPOSITION. XLVIII.

Another way to find out the place of the Moone, without taking the Altitude of any Starre.

Seeke by your croſſe-ſtaffe, to know the diſtance betwixt the Moone and any two Stars that you know, and are to be found in the Globr. That done, draw vpon the Globe on either Star an obſcure circle, according to the diſtance of the Moon from either of thoſe two ſtars, which two circles will cut or croſſe one another but in two points, the one whereof is the place of the Moone, and which of thoſe places it ſhould be, your eye will eaſily tell you. And by this meanes it were no hard thing (as Gemma Friſius ſaith) for our ſea-men in theſe daies to find out all the ſtars that bee in the nether Hemiſpheare.

ſphere and were vnknowne to Ptolomie, and to the other ancient Aſtronomers, & to cauſe them to be ſet downe in the Globe, yea, and by this art the places of the reſt of the Planets may be found out as well according to their Latitude as Longitude.

Moreouer Gemma Friſius ſaith, That by knowing the true place of the Moone in the Zodiaque, you may alſo find out thereby the vnknowne Longitude of any Region.

PROPOSITION. XLIX.

How to find out the Longitude of any Region.

HAuing found out the place of the Moone in the Zodiaque, you muſt firſt know the very houre of her being in that place, and then learne by ſome Ephemerides, or by the Tables of Alphonſus, at what houre the Moone doth enter into the ſelfe ſame degrée of the Zodiaque, in ſome other Region or Towne, whoſe Longitude you alreadie know: and hauing reduced the houres to twentie foure, take the leſſer number of hours out of the greater, the remainder whereof muſt be reduced out of houres & minutes into degrées thus: Multiply the houres by fiftéene, and the minutes of houres by foure, ſo ſhall you haue the degrées of the Equator contained betwixt the two Meridians. And ſuch diſtance ſo intercepted is called the difference of Longitude, which difference you muſt adde to the knowne Longitude, if the houres in that place were more in number, but if the houres were leſſe in number, then you muſt ſubtract the foreſaid difference from the knowne Longitude, ſo ſhal you collect the vnknowne Longitude of that place, or Region which you ſéeke, and how farre it is diſtant from the fortunate Iſles.

PROPOSITION. L.

Another way to find out the vnknowne Longitude of any place by the Globe.

HAuing ſet the Globe at your Latitude and rectified the houre-whéele by yͤ ſeuenth Propoſition, bring the place whoſe Longitude you know to the brazen Meridian, and direct the Index of the houre-whéele to that houre, in which the Moone doth occupy the former defined place in that Region or Towne, that done, leaue not to turne the Globe, vntill the Index of the houre-whéele come to that houre in which you ſought the vnknowne place of the Moone, and the degrées of the Equator which the brazen Meridian cutteth, will ſhew the vnknowne Longitude of the place which you ſéeke.

To the end of this Treatiſe I haue thought good to adde a briefe deſcription of the two great Globes, lately ſet forth by M. Molineux, at the charges of M. Sanderſon, and therewith to ſet downe a briefe deſcription of Sir Francis Drake his firſt vioage into the Weſt and Eaſt Indies, and alſo the voiage of M. Thomas Candiſh, both whoſe vioages, & what courſe they held, may be ſéene by helpe of two ſmall lines, drawne on the terreſtriall Globe, of which lines the one is red, ſhewing the vioage of Sir Francis both outward and homeward, and the other line is blue, ſhewing in like manner the Voyage of M. Candiſh.

A briefe deſcription of the two great Globes lately ſet forth by M. Sanderſon.

THeſe Globes doe differ in a manner nothing at all from the Globes of Mercator, touching the circles before deſcribed, but onely in the Horizon, for the Horizon of theſe great Globes is diuided into 13. ſpaces, as followeth.

Whereof the firſt narrow innermoſt ſpace next vnto the bodie of the Globe, contayneth the degrées of the Zodiaque.

The ſecond contayneth the Numbers of the ſayd degrées, procéeding from 10. to 30. in euery ſigne.

In the third ſpace are ſet downe the names and the Characters of the 12. ſignes, and alſo the Characters of the Planets that gouerne the ſayd ſignes.

In the fourth ſpace are ſet downe the letters of the dayes in the wéeke.

In the 5. and 6. are ſet downe the numbers of the dayes and names of the monethes according to the ancient Calender.

In the ſeuenth the Feſtiuall dayes.

In the 8. and 9. ſpace the number of the dayes and names of the moneths according to the new Roman Kalender.

In the 10. and 11. are ſet downe the Numbers of the dayes and names of the moneths, according to the true Kalender lately calculated by a moſt excellent Mathematitian, and myne old acquaintance M. Dee of Mortlake, as I coniecture by the Letters I.D. ſet downe vpon the Horizon.

In the 12. are ſet downe the Engliſh names of the 32. Rombes or Windes of the Mariners Compaſſe.

In the 13. and outermoſt ſpace are ſet downe the Latine Names of the ſayd 32. Windes.

But the Map which couereth M. Molineux his Terreſtriall Globe, differeth greatly from Mercator his terreſtrial Globe, by reaſon that there are found out diuers new places aſwell towards the North Pole, as in the Eaſt and Weſt Indies, which were vnknowne to Mercator. They differ alſo greatly in the names, Longitudes, Latitudes, and diſtances of ſuch places as haue béene heretofore ſet downe not only in Mercators Globe, which was made many yeares ſince, but alſo in diuers Maps more lately made, but who goeth nigheſt the truth I dare not iudge, becauſe I was neuer in thoſe places. But as touching the Map of ſtars which couereth the celeſtiall Globe of M. Molineux, I do not find it greatly to differ from that of Mercator, ſauing that M. Molineux hath added to his celeſtiall Globe certaine Southerne Images, as the croſſe, the Southerne Triangle, and certaine other ſtarres, whereof ſome doe ſignifie Noes Doue, and others doe ſignifie the Image called Polophilax: the Images wherof are not here ſet downe, but you ſhall find them deſcribed in Plancius his Map, made in the yeare 1592. whoſe longitudes, latitudes, and declinations, how truly they are ſet downe in the ſayd Globe or Map, I am not able to iudge. Hée ſetteth downe alſo two Clouds nigh vnto the South Pole, but not the vſe thereof. Moreouer to this briefe deſcription of M. Molineux his two Globes, I thought good to adde the firſt Voyage of Sir Francis Drake, and of M. Thomas Candiſh, ſet forth by two Lines, the one red, and the other blue, deſcribed in the Terreſtrial Globe of the ſaid M. Molineux, and alſo how farre Sir Martin Forbuſher ſayled Northward, as followeth.

The firſt Voyage of Sir Francis Drake, *by Sea vnto the Weſt and Eaſt Indies both outward and homeward.*

IN the great terreſtrial Globe lately put forth by M. Sanderſon and M. Molineux, the Voyage aſwell of Sir Francis Drake, as of M. Thomas Candiſh, is ſet downe, and ſhewed by helpe of two lines, the one red, & the other blue, whereof the red line procéeding firſt from Plymouth, doth ſhew what courſe Sir Francis obſerued in all his voyage, aſwell outward as homeward, and the blue line procéeding alſo from Plymouth, ſheweth in like manner the Voyage of M. Candiſh, and in that Globe is alſo ſet downe how farre Sir Martin Forbuſher diſcouered towards the North parts. But firſt I will deſcribe vnto you the Voyage of Sir Francis Drake that worthy Knight and moſt Noble Neptune, according as that red line directeth in the ſayd Globe.

Firſt parting from Plymouth, he ſayled with a North North-Eaſt wind to an Ile calles Mogodore, vpon the Coaſt of Marroccho, which place is not named in M. Molineux his Globe, and that place hauing in North Latitude 32. degrées, is diſtant from Plymouth according to that courſe, which the red Line ſheweth 420. leagues. In this Ile hee built a little Pinnis or Shallop, and from thence he ſailed to Cape Dalguere which is further Southward, and hauing in North latitude 30. degrées, is diſtant from Mogodore about 40. leagues, and from thence he ſailed to the Iles Canarie, which are ſomewhat more Weſtward, and hauing 27. degrées 30'. in North latitude, are diſtant from the Cape Dalguere about 100. leagues, & from thence he ſayled to Capo Blanco, which is more Weſterly, and hauing in North latitude 21. degrées, is diſtant from the Canaries 130. leagues and ſomewhat more, and from thence he ſayled to the Iles of Capo Verde which hauing in North latitude about 15. degrées, are diſtant from Capo Blanco about 140. leagues. And from thence to the great Cape of S. Auguſtine, which hauing in South latitude about 8. degrées, is diſtant from Capo Verde 500. leagues, and from thence hee ſayled more Weſterly vnto the mouth of the Riuer called Rio de Platta, which hauing in South latitude 36. degrées is diſtant from Cape S. Auguſtine, 760. leagues, and from thence to the Port S. Iuliano, hauing in South latitude about 50. degrées, whereas one Doughtie was executed for Conſpiracie, and this Port is diſtant from Rio de Platta 370. leagues. And from thence hee ſayled to the Cape Virgine Maria, which hauing in South latitude 52. degrées 3'0. is diſtant from Port S. Iulian 50. leagues, & frõ thence ſtriking in betwixt the Ile, whoſe Northeaſt Cape is called the Ile of the name of Ieſus, and the Port Famine, hee entred into the ſtraight Magellane, which hauing in South Latitude 53. degrées 3'0. is diſtant from the Cape Virgine Maria 60. leagues, and from thence he paſſed through the Magellane ſtraights to yͤ Cape de Sancto Spirito, which is a Cape of the Southland, hauing in South Latitude, 52. degrées 2'0. and is diſtant from Cape Virgine Maria about 160. leagues, from thence he ſayled ſomewhat Weſterly about 20. leagues, and there fetching a turne about certaine Ilands called Las Anegadas, hee tooke his courſe Northward alongſt the Weſt Coaſt of America, vnto the Ile Lima, which hauing in South Latitude 12. degrées, is diſtant from the Ilands called Las Anegadas 840. leagues, and from thence hee ſailed ſtill Northward vnto Cape Guija, which hauing

hauing in South Latitude 6. degrées 1'0. is diſtant from the Ile Lima 160. leagues, frõ thence ſtill Northward he ſayled to Cape S. Franceſco, which hauing in North latitude 1. degrée 30 minutes, is diſtant from Cape Guija 170. leagues, from thence he ſayled ſtill Northerly to the Cape Mondecino, which is in the Land called Quiuira, and this Cape hauing in North Latitude, 40. degrées, is diſtant by that courſe from S. Franceſco 1740. leagues, from thence he ſayled ſtill Northward vnto a certaine Bay in the Weſt part of Quiuira, which hee named Noua Albion (that is to ſay) new England, hauing in North latitude 46 degrées, & is diſtant frõ the Cape Mondecino 140. leagues. And this was yͤ furtheſt part of his voiage outward, in which voiage he ſailed in all 5780. leagues, & from this Bay Sir Francis himſelfe (as I haue heard) was of very good wil to haue ſayled ſtil more Northward, hoping to find paſſage through yͤ narrow ſea Anian, which ſea is not ſet downe by M. Molineux in his Terreſtriall Globe as a ſtraight, but rather as a maine ſea, bearing in breadth 400. leagues, and ſo from thence to haue taken his courſe Northeaſt, and ſo to returne by the Iles Crockland and Groyneland into England: but his Mariners finding the Coaſt of Noua Albion to be very cold, had no good wil to ſaile any further Northward, wherfore Sir Francis was faine to come back againe Southward to Mondecino, which (as hath béen ſaid before) is diſtant from the foreſaid Bay of Noua Albion 140. leagues. From thence he ſayled in a manner right Southweſt to the Iles Moluccas, and touched at the Iles Ternate, Tidore, Machian, and Motil, which are nigh vnto the Ile Gilolo, which is right vnder the Equinoctiall, amongſt which Iles he remayned a certaine time, of which Ilands the Ile called Ternate hauing about one degrée 3'0. of North Latitude, is diſtant by that courſe from the Cape Mondecino 1140. leagues, & from thence he ſayled Southweſt vntill he came to the Weſt end of the Ile Iaua maior, which hauing in South Latitude nine degrees 30. minutes, is diſtant from the Ile Ternate by that courſe 620. leagues, and from thence he ſailed ſtill Southweſt to the Cape di Buona Speranza, which hauing in South Latitude 35. degrees, is diſtant from Iaua maior 1660. leagues, then from

Capo di Buona Speranza, he making his courſe Northweſt ſayled to an Iland called Sierra Liona, which is vpon the Coaſt of Afrique, and hauing in North latitude 7. degrees 3'0. is diſtant from Capo di Buona Speranza 1100. leagues, then from thence he ſayled towards the Iles of Capo Verde, vntill he came to the 12. degree of North Latitude, right vnder the firſt Meridian, which point is diſtant from the Iland Sierra Liona, according to that courſe 320. leagues, & from thence hee ſayled Northward nigh to the Iles called Azores, on the Weſt ſide thereof, which hauing of North latitude 40. degrees, are diſtant by that courſe from the Iles of Capo verde 600. leagues, from whence he directed his courſe Northeaſt to Plymouth, which hauing in North latitude 51. degrees, is diſtant by that courſe from yͤ Azores 500 leagues, ſo as in his returne from Noua Albion to Plymouth, he ſayled in all 6080. leagues, which if you adde to the Number of leagues of his outward Voyage before ſet downe, which is 5780. leagues, you ſhall find the totall ſumme of the leagues to be 11860. leagues, which is almoſt twiſe ſo much as yͤ Compaſſe of the whole world, which if you meaſure vpon the Globe by the Equinoctiall line, containing 360. degrees, and doe allow for euery degree thereof 60. Italian myles, you ſhall finde the Number of ſuch myles to amount to 21600. myles, which by allowing three myles to a league doe make no more but 7200. leagues. But if it might pleaſe ſome expert Mariner to write a perfect Diarie of his whole Voyege, ſhewing how much hee ſayled in a day, and what watering places he found, and where he touched, and how long he reſted in any place, and what good Ports and Hauens he found, and what anchorage good or bad, and what manner of people, what trade of liuing, & what kind of building & gouernmēt they vſed, as wel in ciuil as in martial affaires: Alſo in what Aire they liued, and whether the ground were fertile or barren, dry or well watred with floods and fountaines, what mountaines, what mines, what woods or forreſts, what beaſts, fowles, or fiſhes, fruits, hearbs, plants, or other commodities he found therein, and in what manner of ſeas he ſayled, and what winds and currents were moſt riſe in euery place: Alſo what rockes, ſands, ſholds, and all other places

of danger and perill, and by what markes ſuch places are to be ſhunned: And finally, what Moone doth make a full Sea in euery Port where arriued, and what windes doe alter any tyde or current, and al other neceſſary accidents moſt meet for Sea-men to know. In thus doing I ſay he ſhould greatly profit his Country-men, and thereby deſerue immortall fame. Of all which things, I doubt not but that hee hath alreadie written, and will publiſh the ſame when he ſhall thinke moſt meet.

The Voyage of M. Candiſh *vnto the Weſt and Eaſt Indies, deſcribed on the Terreſtriall Globe by the blue Line.*

This blue Line as you ſee taketh his beginning from Plymouth like as the red Line doth, wherby you may plainly ſee, that M. Candiſh did not greatly differ in his courſe from that which Sir Francis held, ſauing that M. Candiſh hauing once paſſed the ſtraight Magellane Weſtward, ſayled not ſo farre Northward as Sir Francis did, for he ſayled no further Northward, but to the Port S. Lucas, which is almoſt vnder the Tropique of Cancer. For that Port hath in North Latitude 22. degrees 3'0. keeping alwayes a nigher courſe vnto the main, then Sir Francis did, and from the Port S. Lucas, he ſayled in a manner Southweſt about 320. leagues, and then hee directed his courſe Weſtward towards the Moluccas: and before hee came to the Moluccas, he fetched about the Ile Catanaim, which is more Northward then Sir Francis went in thoſe parts, and from thence he ſayled full South to the Moluccas, from whence he directed his courſe Southweſt, and paſſed betwixt the Iles Iaua Maior, & Iaua Minor, which two Iles in yͤ ſaid great globe are made to haue one ſelfe latitude (that is to ſay) about 10. degrees of South latitude, counting from the Equinoctiall to the Parallel which paſſeth through both the Iles. But in all other

Globes and Mappes Iaua minor ſtandeth 10. degrees more to the South, and is placed behind the South Promontorie called the Land of Beach. Then hauing paſſed betwixt the foreſaid two Iles, he held in a manner the like courſe that Sir Francis did in his returne to Plimouth, which the blue line doth ſhew ſo plainly as it needeth none other deſcription. Now as touching Sir Martin Forbuſhers voyage, becauſe his owne deſcription thereof is in print, nothing is ſet downe in this Globe. but onely the outermoſt end of his Voyage, named here Forbuſhers ſtraights, hauing in North Latitude about 63. degrees, in the mouth of which ſtraights is a little Iland called Hales Iland on the right hand, and on the left hand another little long Iland called Leceſters point. Truly this Knight for his valorous venter, aſwell in this Voyage as in diuers other his worthy Seruices done vpon the Sea, deſerueth great commendation, and I wiſh with all my heart that he and ſuch like might be much made of, and rewarded according to their deſert. And thus I leaue to ſpeake any further of M. Molineux his Globes, the vſe whereof is to be learned by thoſe Propoſitions which I haue heretofore ſet downe, ſhewing the vſe of Mercator his two Globes: for the practiſe and manner of working both by his Globes, and by theſe Globes, is all one.

A
Plaine and full Deſcription of Petrus Plancius his vniuerſall Mappe, ſeruing both for Sea and Land, and by him lately put forth in the yeere of our Lord, 1592.

In which Mappe are ſet downe many more places, as well of both the Indies, as of Afrique,
together with their true Longitudes and Latitudes, then
are to be found either in Mercator *his Mappe, or in*
any other Moderne Mappe whatſoeuer: And this Mappe
doth ſhew what Riches, Power, or Commodities, as
what kind of Beaſts both wild and tame, what
Plants, Fruits, or Mines any Region hath,
and what kinds of Marchandizes do
come from euery Region.

Alſo the diuers Qualities and Manners of the
People, and to whom they are ſubiect. Alſo who be the
moſt mightie and greateſt Princes of the World: A Mappe
meet to adorne the Houſe of any Gentleman or Marchant,
that delighteth in Geographie: and therewith this Booke is
alſo meete to be bought, for that it plainely expoundeth euery thing contained in
the ſaid Mappe.

Written in our Mother Tongue by M. Blundevill.

LONDON,
Printed by William Stansby.

IN DOCTISSIMI VEREQVE GENEROSISSIMI VIRI THO. BLVNDEVILI in PETRI PLANCII Tabulam Geographicam & Hidrographicam elucidationes GVALTERI HAWGHI

Δεκατετράστιχον.

PLANCIVS *in Tabula terras deſcripſit & Vndas,*
Quæcunque & toto condidit orbe Deus:
Multiplices horum partes, Regumq́; per illas
Sceptra ſuperba, ſimul totius orbis opes.
Sed ſolis Gallis hæc PLANCIVS, *atq́; Latinis,*
Inter & hos, Doctis ſcripſerat, haud alijs.
Tu Generoſe tuis Patrio hæc Idiomate clarè,
BLVNDEVILE *refers, Cunctaq́; nota facis.*
Tu ſimul hæc auges, lucemq́; his addis, & horum
Vſum multiplici non ſine fruge doces.
Nec ſolum doctis, ſed & omnibus hæc Idiotis:
Perſpicua vt patent, tu breuitate facis.
PLANCIVS *hæc alijs, tu nobis omnia tradis.*
Tuque tuis Anglis PLANCIVS *alter eris.*

A plaine and full deſcription of PLANCIVS his vniuerſall Mappe, ſet forth in the yeere of our Lord 1592. Written in our Mother Tongue by M. BLVNDEVILL.

IN this Mappe, as you ſée, are drawne with red Inke two Lines or Diameters, croſſing one another with right Angles in the very midſt of the Mappe, whereof the perpendicular Diameter paſſing through the Iles Azores, and alſo through the Iles of Capo Verde, ſignifie the firſt Meridian and Axeltrée of the World, at the vpper end whereof is ſet the North Pole, and at the nether end the South Pole. And the other ouerthwart Diameter ſignifieth the Equinoctiall, and alſo the Line of Eaſt and Weſt, that is to ſay, Eaſt on the right hand, and Weſt on the left hand. And in this Line are ſet downe the degrées of Longitude, which are to be counted from the foreſaid firſt Meridian vpon the ſaid Equinoctiall, towards your right hand from one degrée to 180. ſet downe in Arithmeticall figures thus, 10. 20. 30. and ſo forth, vntil you come to 180. which is the Eaſt Longitude of yͤ World, and the Weſt Longitude beginneth on your left hand, whereas is ſet downe 190. and then 200. and ſo forth, vntill you come to 360. degrées, which is the whole circuit of the Equinoctial, and of the whole Earth. And in the firſt Meridian are ſet downe the degrées of Latitude, which do procéed from the Equinoctiall to eyther of the Poles, from one degrée to 90. written in Arithmeticall

ticall figures thus, 5, 10. 15. and ſo forth to 90. which degrées do procéed with equall diſtances from the Equinoctiall to eyther Pole, and the like degrées of Latitude are alſo ſet downe vpon the two outermoſt Meridians, as well on the right hand, as on the left. And on each ſide of the Equinoctiall are drawne with red Inke the two Tropiques, that is to ſay, the Tropique of Cancer, and the Tropique of Capricorne, each one being diſtant from the Equinoctiall 23. degrées, 30 which is the greateſt declination of the Sunne, and towards each Pole are alſo drawn with red Inke the two Circles both Arctique and Antarctique, whereof the Circle Arctique paſſeth through the Northerly part of Iſland, hauing in latitude 66. degrées, 3'0. and the Circle Antarctique paſſeth through the like degrées of Latitude towards the South Pole, & the diſtance of each of thoſe Circles from eyther Pole is equall to the greateſt declination of the Sun. And theſe 4. Circles are Parallels to the Equinoctial, bounding the 5. Zones, that is, the two Cold, the two Temperate, and the hot Zone, which lieth in the midſt of the World betwixt the 2. Tropiques. And on the left hand or Weſt part of the Mappe are ſet downe from the Equinoctial vpward towards the North Pole, what number of miles and ſeconds of miles do belong to euery degrée of the North Latitude, procéeding from the Equinoctiall towards the North Pole: for though that euery degrée of the Equinoctiall, being a great Circle, containeth 60. miles, yet the farther that you goe from the Equinoctiall towards eyther of the Poles, the leſſer and leſſer are your Parallell Circles in compaſſe, and therefore one degrée of euery ſuch Parallell muſt néeds containe the fewer miles. But becauſe the Sea-men doe commonly make their account on the Sea by leagues, and not by miles: Plancius here, right vnder the former Table of miles, ſetteth downe the number of leagues incident to euery Degrée or Parallell, in deſcending from the Equinoctiall to the South Pole, appointing thrée miles to a league, and therefore he ſetteth downe vpon the very Equinoctiall 20. leagues, which is 60. miles, and next to that he ſetteth downe 19. leagues, 5'9. and ſo procéedeth forth, diminiſhing ſtill the quantity of the leagues, euen til you come to the very South Pole, and

on

on the right hand of the Mappe hard by the outermoſt Meridian, are ſet downe the nine Climes, and the longeſt day in euery degrée of Latitude, procéeding as well from the Equinoctiall to the North Pole, as alſo from the Equinoctiall to the South Pole, from 12. houres to 187. dayes and 7. houres, which maketh the Longeſt day to thoſe that dwell right vnder the North Pole, to be halfe a yéere, and the Night as much. Beſides the Circles & Lines before mentioned, there are ſet downe in this Mappe certaine Flyes of the Mariners Compaſſe, each one containing 32. Lines, which doe ſignifie the 32. Rombes or Winds of the Mariners Compaſſe, to know thereby how one place beareth from another, and by what Wind the Mariner hath to ſayle to any place whereunto he would goe: In euery which Flye, the Line of North and South may ſerue in ſtead of a Meridian, and the Line of Eaſt and Weſt, may ſerue as a Parallell, by helpe whereof you may the more readily take with your Compaſſes, the Longitude and Latitude of any place contained in the Mappe, in ſuch manner as is taught in my firſt Treatiſe of Vniuerſall Mappes. Alſo in the very front of his Mappe, he ſetteth downe the numbers of 24. houres, euery houre containing 15. degrées of the Equinoctiall, which houres doe begin on the right hand, and ſo procéed to the left, whereof the 12. houre is placed at the end of that Meridian, which paſſeth through the fortunate Iles. Now betwixt the 72. and 86. degrées of North Latitude, he ſetteth downe two long Ilands, extending from the Weſt towards the Eaſt, ſomewhat beyond the firſt Meridian, and from the ſaid Meridian more Eaſtward, he ſetteth downe other two long Ilands, affirming, that the North Ocean Sea breaking in betwixt theſe Ilands with 19. Gates or Entrances, maketh foure ſtraits, and is continually carryed vnder the North Pole, and there is ſwallowed vp in the bowels of the Earth. And he ſayth further, that right vnder the North Pole there is a certaine blacke and moſt high Rocke, which hath in circuit 33. Leagues, which is 99. miles, and that the long Iland next to the Pole on the Weſt, is the beſt and moſt healthfull of all the North parts. Next to the foreſaid Ilands, more Southward, hee ſetteth

downe

downe the Ilands of Crockland & Groyneland, making them to haue a farre longer and more ſlender ſhape then all other Mappes doe: at the Eaſt end of the third long Iland, is a ſtrait hauing fiue gates or entrances, which by reaſon of their narrowneſſe and ſwift courſe of ſtreame, are neuer frozen. If this be true, I maruell how any ſhippe durſt enter through any of thoſe ſtraits, to diſcouer the North ſides of any of thoſe Ilands, and how and where it came out againe: Moreouer, at the Eaſt end of the laſt Iland, ſomewhat to the Southward, he placeth the Pole of the Loadſtone, which is called in Latine Magnes, euen as Mercator doth in his Mappe, who ſuppoſing the firſt Meridian to paſſe through Saint Mary, or Saint Michael, which are two of the outermoſt Ilands of the Azores Eaſtward, placeth the Pole of the Stone in the 75. degree of Latitude: but ſuppoſing the firſt Meridian to paſſe through the Ile Coruo, which is the furtheſt Ile of the Azores Weſtward, hee placeth the Pole of the Loadſtone in the 77. degree of Latitude. I thought good to ſeuer the Ilands laſt before mentioned from the body of the Mappe, as parts belonging rather to the North Pole, then to Europe, Aſia, Africa, or America: for if Virgil did not let to ſay, that England was Penitus excluſa ab orbe, me thinkes that I may much more rightly ſay the like of theſe Ilands, notwithſtanding Plancius maketh the firſt two long Ilands, and alſo Groynland and Crockland, to be part of Mexicana; which mee thinkes is not meete, ſith they bee diuided by the North Sea: likewiſe he maketh the Land which is vnder the South Pole, and is not as yet diſcouered, to be part of Magellanica, which (in mine opinion) ought not to bee ſo, ſith it is not onely diuided from Magellanica, by the ſtraight Magellanicum, but alſo from Afrique and from the Eaſt Indies by the great Northerne Ocean. And I beleeue that when the Southland ſhall bee all diſcouered, it will contayne twice ſo much Land as Magellanica doth, and then I doubt not but that the Geographers will giue it ſome other name, and make many Diuiſions thereof. In the meane time I will follow Plancius his owne Diuiſion of the World, which greatly differeth from that of Mercator, and of all

other

other moderne Geographers, for they doe diuide the whole Earth but into foure parts, that is to ſay, Europe, Afrique, Aſia, and America: but Plancius, by diuiding America into three parts, that is, into Mexicana, Peruana, and Magellanica, diuideth the whole Earth into ſixe parts, that is to ſay, Europe, Aſia, Afrique, and into the three parts of America laſt mentioned, according to which diuiſion, he deſcribeth the Earth in the French Tongue in ſixteene pages, ſet downe at the foot of his Mappe: the foure laſt pages whereof doe onely containe the interpretation of the 71. little Tables or Inſcriptions written in the Latine Tongue, diſperſed throughout the whole Mappe, expreſſing therein ſuch things as he thought moſt meet to be noted in diuers parts of the World: all which Tables or Inſcriptions, I haue here alſo ſet downe in our Mother Tongue. And although that to the foreſaid Tables or Inſcriptions, Plancius hath attributed certaine Numbers, for the more eaſie finding out of the ſaid Inſcriptions, yet not eaſie enough, by reaſon that one ſelfe Number is ſet downe in diuers Tables: and therefore, to the intent that you might the more readily find out euery Table that is proper to the matter whereof it maketh mention, I haue here following ioyned to the Number of euery ſuch Table his proper Longitude and Latitude, which with your Compaſſe you may quickly find, and more certainly, then by his Numbers, if you remember the order thereof ſet downe in my Treatiſe of vniuerſall Mappes.

But now I will declare the Contents of
the foreſaid ſixteene Pages, in
order as followeth.

The

The Title of the firſt Page is thus:

A briefe declaration of the diuiſion, forme, or ſhape, and of the particularities of the World.

The Contents of the firſt Page.

THat the Earth and the Water doe make both together one round Body, which the Coſmographers doe inuiron with fiue Circles, that is, the Equinoctiall, the two Tropiques, and the two Polar Circles, and thereby doe diuide the World into fiue Zones, two cold, two temperate, and one extreme hot: and though that the ancient Geographers doe affirme, that thrée of thoſe Zones were vnhabitable, the one for extremitie of heat, and the other two for extremitie of cold; yet within theſe hundred yéeres laſt paſt, it is knowne by good experience, that thoſe thrée Zones are well inhabited, as the manifold Countries therein placed, are greatly repleniſhed with people of ſundry Languages, doe well teſtifie: of all which things I haue written at large in my Sphere. And therefore I make this Page the ſhorter.

The Contents of the ſecond Page.

TO know the true ſituation of the Prouinces and places contayned in this Mappe, it is neceſſary firſt to know their Longitudes and Latitudes. The degrées of Latitude, or of the eleuation of the Pole, which is all one thing, are counted from the Equinoctiall to eyther Pole, which is 90. degrées, and the degrées of Longitude are counted vpon the Equinoctiall, from the Iles of Capo Verde towards the Eaſt, and ſo round about the Earth, vntill you come to the number of 360. degrées. The Prouinces and Townes that are ſituated vnder one degrée of longitude, haue at one ſelf time like houres of the day, but thoſe that are ſituate vnder diuers degrées of longitude, doe differ in number of houres, for when it is in one Towne noontyde, it is in another Towne, that is diſtant from thence towards the Eaſt 30. degrées, two of the clocke in the afternoone, and ſo conſequently for euery 15. degrée of diſtance they differ an houre. Likewiſe they that dwell vnder one ſelfe degrée of Latitude haue equall quantity of dayes and nights, but yet ſo as they which dwell on the South ſide of the Equinoctiall haue the ſhorteſt day when wée haue the longeſt, and haue Winter when we haue Summer. But thoſe that are ſituate vnder diuers degrées of latitude, haue inequalitie of dayes and nights, for the nigher that any place is ſituate towards any of the Poles, the more houres the longeſt day of the yeare in that place contayneth, but thoſe that dwell right vnder the Equinoctiall haue alwayes their dayes and nights of like quantity. And I vnderſtand héere by the day, the ſpace betwixt the Sun riſe, and the Sunne ſet, and you ſhall find the quantitie of the longeſt day of the yeare in euery degrée of latitude ſet downe in the Northeaſt part of this Card. As for example, to thoſe that haue 30. degrées of latitude, the longeſt day is 13. houres 5'7. and ſo the nigher that you goe to the Pole the longer is the day, in ſo much as thoſe that dwell right vnder the Pole, the yeare is but a day and a night, that is to ſay, they haue 6. moneths day, & 6. months night. Moreouer the Geographers do diuide the earth into 9. climes for to diſtinguiſh therby the Prouinces & Regions by the quantity of the longeſt day, the middlemoſt paralel of euery clime increaſing by half an houre. And you haue to conſider yͭ the degrées of latitude are in al places of like bigneſſe, euery degrée containing 15. Alman leagues or 60. Italian myles, but the degrées of Longitude procéeding from the Equinoctiall towards any of the two Poles are vnequall, yͭ is to ſay, euery one contayning fewer leagues or miles then other, but the degrées of the Equinoctiall it ſelfe are equal to the degrées of latitude, euery one contayning 15. Germane leagues or 60. Italian miles, as you may plainly ſée in the Table ſet downe in the Northeaſt part of this Map. And you haue to note that one Almaine league doth contayne foure Italian miles, and we haue deſcribed the degree of Longitude, in the Southweſt part of this Card, by the houres of the ſhips way, euery one decreaſing leſſe then other from the Equinoctiall to the Pole, whereby you may conceiue, that two ſhips being right vnder the Equinoctiall 150. degrees diſtant one from another, and are to ſaile with like gate towards the North Pole, when they ſhall come to the *60.* degree of Latitude, their diſtance ſhall be no more but 75. leagues. And the further they goe towards the Pole, the leſſe diſtance they ſhall bee one from another, inſomuch as when they be right vnder the Pole it ſelfe, they ſhall both meet, as you may ſee in the 2. round figures contayning the deſcription of the Earth, and ſet downe in the 2. nether corners of the Map. This matter is to bee conſidered of the Mariners, that they may thereby the better perceiue the imperfections of their Sea Cards. Moreouer, in the ſecond Page Plancius ſetteth downe the diuiſion of the Earth, as well according to the ancient as moderne Geographers, making firſt three generall Continents or firme Lands, whereof the firſt is ſo much as was knowne to Ptolomey, and to the ancient Aſtronomers, as Europe, Afrique, and Aſia: the ſecond Continent is called America, and the third Continent is the South part of the World, not yet fully diſcouered, called of Plancius, Magellanica, and hee diuideth the ſecond Continent called America into three parts, that is, Mexicana, Peruana, and Magellanica, and by adding thoſe three parts to Europe, Afrique, and Aſia, he diuideth the Earth into ſixe parts, and firſt hee ſetteth downe the deſcription of Europe together with her bounds or limits, and then the commodities thereof, as followeth.

Of Europe.

Europe is farre leſſe then all the reſt, and yet exceedeth all other in nobleneſſe, in magnificence, in multitude of people, in might, puiſſance, and renowne, the which in times paſt hath commanded both Aſia and Afrique as Queene, by reaſon of the Monarches of the Greekes and of the Romanes, and at this day is of great force by the power of the Turks and Muſcouites. Moreouer it commandeth many Prouinces in Mexicana and Peruana, by the power of the Spaniards and Portugals, and of other Chriſtian Princes.

Europe is ſeuered from Aſia, and Afrique by the Sea Mediterraneum, & by the Sea called Mare maior, and by the Mariſh or Sea called Palus Meotis, and by the floud Tanais & Dwina. The chiefeſt Prouinces of Europe are theſe, Almanie, Italy, France, Spaine, Denmarke, Norway, Swethland, Muſcouia, Polonia, Hungaria; Sclauonia and Greece. The chiefeſt Ilands of Europe are theſe, England with Scotland, Ireland, Sardinia, Corſica, Sicilia, Candia, Nigro Ponte ſometime called Euboia, and Scalimine ſomtime called Lemnos, And in this ſecond page he ſetteth downe alſo the deſcription of Almanie thus.

Almanie is reputed to bee the greateſt Prouince in all Europe, and is ſituated in the middeſt thereof, which is bounded on the Eaſt with Polonia, and Hungaria, on the South with Dalmatia, and Italia, and on the Weſt with France, and on the North with the North Sea, and with the Sea called Mare Balticum. The Inhabitants of this Countrey warred in olde time with the Romanes for their libertie, and ſince many hundred yeares paſt it hath holden the Imperiall Scepter. About the time of Chriſt his birth, it was a rude Countrey, as Cornelius Tacitus ſaith, full of Wood, Buſhes, and Mariſhes, but at this day it is ſo adorned with great magnificent townes and well fortified, and is furniſhed with ſuch a number of Caſtles and Villages, and with ſuch a number of people, and with ſuch Politique Gouernment, as it is to bee compared to any Prouince whatſoeuer in all the World. The ſoyle thereof is very fruitfull both for Corne and Wine, and hath many Nauigable Flouds ſtored with plentie of Fiſh. It hath moſt excellent Fountaines and hot Bathes, great Mines of Gold and Siluer, Copper, Tinne, Lead, and Iron. The Inhabitants doe exerciſe as well now as they haue done in times paſt the Art Military, and it hath many leraned men very ſkilfull in all Sciences, and in Mechanicall Arts: they were the Inuenters of Artillery, of Gunpowder, and of the Noble Art of Printing, and of making artificiall Dyals and Horologies.

The chiefe Merchandizes that are tranſported out of Almanie into other Countries are theſe, Gold, Siluer, Copper, Tin, Lead, Vitrioll, Allum, Quickſiluer, Colours of diuers ſorts, Slates, to couer Houſes, Wheate, Wine, Fiſh, Woollen cloth, Linnen cloth, Bombaſine, Fuſtian, Suille, Armour, all ſorts of Workes made of Iron or Braſſe, and other Merceries.

The Contents of the third Page.

IN the third Page he deſcribeth the 17. Prouinces of the Low Countries, alſo Italy, France, Spaine, and Denmarke, as followeth.

THe 17. Prouinces of the Low Countries are counted a part of Almanie, by reaſon that the moſt part of the Inhabitants haue as well their originall as their Language from yͤ Almaines. But thoſe of Artoys, of Henough, Namures, and part of the Inhabitants of Brabant, Flanders, Lymburgh, and Liczenburgh do ſpeake the French Tongue. Theſe Prouinces are ſituate partly within the ancient limits of Almaine, that is to ſay, beyond the Orientall part of the floud Rhenus, and partly in Gallia Belgica, as alſo are the Prouinces of 4. yͤ Princes Electors & of many other Prouincis of the Empire. In theſe Prouinces are many nauigable flouds, and rich in fiſh, namely the Rhene, Moſella, Moſa, and the Eſcaut, and there is great abundance of all ſorts of Corne and Catell meet for mans vſe, there is alſo a number of great Townes, rich, mightie, and well peopled, alſo of Fortreſſes well fortified, faire Villages, but chiefly of braue and commodious Ports and Hauens, and an incredible number of ſhips, and the continuall wars that they haue had and haue at this day doe witnes to all the world their great force, might, and riches. The Inhabitants in time of the Romane Monarchy were, and alſo are at this preſent greatly renowned for their ſkill in the Art Militarie, and beſides that, they are moſt excellent and induſtrious in all Sciences and Mechanicall Arts, and they haue a great Number of Mariners

and Pilots well practiſed in the Arte of Nauigation, and to theſe Prouinces is attributed the inuention of the Mariners Compaſſe, according to the opinion of many learned men, which truely is one of the Nobleſt Inuentions that euer was found out ſince the World began. In the Towne of Burgheſſe was inuented the Art of Painting with Colours tempered with Oyle.

The Prouinces of Belgia, do ſend vnto other Prouinces, all ſorts of Clothes made of Wooll and Flaxe, Linnen Cloath of Cambria, Skarlets enterlaced with Gold, Siluer and Silke, Taffeties, Borattas, Grograines, ſingle Buffen, Seyes of Leyden and Howſcot, Worſteds, and halfe Worſteds, Fuſtianapes of Vellures, and of Wooll, Bayes, Silke, Parchment-lace, Sarcenet and Inkle, all manner of twiſted Threed, Silke readie dreſt, purified Sugar, Buffe, Shamoyes, ſtriped Marokines, painted Pictures, Bookes, Armour, Cables, Ropes, and other Munitions belonging to Ships, Kniues, Pins, and all ſorts of Mercerie or Haberdaſh Ware, and Fiſh dryed and ſalted.

ITaly being the Mother of Eloquence & of all Latine Erudition, doth extend it ſelf like an arme towards the Southeaſt, lying betwixt the Tuſcane ſea & the gulfe of Venice, & is bounded on the Weſt part with France, & on the North part with Almanie, being ſeparated frõ the ſaid two Prouinces by the floud Varo & the Alpes, & all the reſt is inuironed with the ſea. At the time of the Natiuity of Chriſt, and ſince, ſhe moſt flouriſhed, being adorned with the fourth Monarchy, & with the moſt mighty towne of Rome, which at that time was Queene of many Prouinces of Europe, Aſia and Afrique, which Citie in the time of the Emperour Veſpaſian, had in circuit 13. Italian myles and 200. paces, as Plinie writeth in his third Book and fift chapter: Clauius Vopiſcus reciteth that this Towne was inlarged by yͤ Emperour Aurelius to 30. Italian myles, which is 10. houres of way or gate, allowing three myles for an houre. This Prouince hath brought forth, as it doth at this preſent, inhabitants of great induſtry and wit, and it contayneth many noble cities and of great renowne, as Rome, which hath beene ſomtime the head of the world, Venice the rich, Rauenna the ancient, Naples the gentle, Florence the beautifull, Genua the proud, and Millaine the great. In a towne called Amalphe ſituate vpon the ſea, betwixt Naples and Salerno, the Mariners Compaſſe was inuented in the yeare 1300. according to the opinion of ſome, by one Iohn Goia, citizen of the ſame town: notwithſtanding Iohn Gorop Becanus doth attribute that inuẽtion to Flanders which ſeemeth the more likely, for ſo much as all the Pilots and Mariners of France and Spaine, and other places, do name the 32. winds or rombes of the Compaſſe by the Belgick names. The chiefe Merchandizes that are ſent out of Italy into other Countries are theſe, Rice, Silke, Veluet, Satten, Taffaties, fine peeces of Linnen, Grograines, Raſh, Stamin, Bombaſins, Fuſtians, Feltes to make riding Clokes, plentie of rich Armour, Wyar of Gold and Siluer, Allum, Galles, drinking Glaſſes, and looking Glaſſes of Venice.

France hath been alwayes eſteemed to be the chiefeſt Realme of all Europe, whoſe ſoyle is moſt fertile, and bringeth forth all kind of Graine, and euery other thing that is neceſſary for mans ſuſtenance; there is great ſtore of wine, and great plenty thereof is diſtributed to other Prouinces nigh adioyning. The Prouince doth abound in Oyle Oliue, & in Corall, and in many other noble fruits. In France are many great Townes well walled, as Paris, Roan, Amiens, Orliens, Toures, Nants, Poictiers, Burghes, Tholous, Lyon, Narbona, and Marcelles. It hath 15. Archbiſhopricks, and 108. Biſhopricks, and a great number of townes & villages, and 132000. Pariſhes, it is greatly peopled, and hath not ſuch Deſarts or Heathes as are in other Prouinces of Europe. The Frenchmen haue beene, and are at this preſent renowned in the Art Militarie, and there be many learned men in all Faculties and Sciences.

The chiefe Merchandizes that are carryed out of France into other Prouinces are theſe, Wheate, Rie, Beeues, Hogges, Swine, and other Cattell, Salt, Wines, wilde Oliues, Cheſnuts, Almonds, Prunes, Corall, Dyers Wadde, Clothes, Linnen, Canuaſſe, and Skins.

Spaine is inuironed round about with the Sea, ſauing that on one ſide it is ſeparated from France by the Mountaines Perenei. This Country was ſometime diuided into three Prouinces or Kingdomes, that is, Taraconenſis, Luſitania, and Betica, but now it is ſubdiuided into many Realmes, that is to ſay, Caſtilia, Aragon, Portugall, Gallicea, Lyon, Nauarra, Toledo, Valentia, Murcia, Granado, Cordoa, and Algarbia, the which Realmes if they had beene reduced to one bodie of a Realme as France is, and as they bee at this houre ſubiect to one onely King and Lord, it ſhould be without doubt one of the moſt mighty and puiſſant Kingdomes of Europe. The Inhabitants of Spaine haue beene and are at this preſent much renowned in the Art Military, and in Feates of Warre, and it hath brought forth in times paſt many great Clarkes, as Seneca, Quintilian, Lucan and Martial, and in our time it had Iohannes Ludouicus Viues, Iohannes Oſorius, and Benedictus Arias Montanus. The Prouinces of Spaine are become verie rich and mightie, by reaſon of their Nauigation into America, Africa, Arabia, Perſia, India, the Molucas and China, in which Prouinces (China excepted) the King of Spaine poſſeſſeth many Countries that be rich and of great power, and many Townes and Fortreſſes, in a manner round about the Earth.

The chiefe Merchandizes that grow in Spaine, and are carryed into other Countries are theſe, Wines, Oyles, Rice, all ſorts of Fruits of Spaine, Liquoras, Silke, great quantitie of Wooll, Lambe-ſkins, Corke, Roſin, Steele, Iron and Armour.

Denmark and Norway are very great Regions, and are as large as the countries of Almany, bordering vpon Almany towards the South, they extend towards the North to 71. degrees 30′. of North Latitude, and towards the Eaſt they border vpon Swethland, and on the Weſt and North ſide they are inuironed with the Sea. Theſe two Realmes are at this day vnder the gouernment of one only King, who alſo is Lord of Iſland, and of the Iles of Fero, Hitland, and Gothland.

Iuthland was ſometime the habitation of the Cimbres, who in times paſt made cruell Warres againſt the Romanes.

The Merchandizes ſent from the two foreſaid Realmes into other Prouinces are theſe, Oxen, Barly, Malt, Stockfiſh, Tallow, Nuts and Filbirds, Hides of Oxen, & Buck-ſkins, Maſts for ſhips, planks & the tops of Wainſcot, Soliues and fire wood to burne, Pitch and Tarre, Sulphur and ſuch other things.

The Contents of the fourth Page, wherein he deſcribeth Swethland, Polonia, Hungaria; Sclauonia, Greece, England and Scotland, as followeth.

SWethland is a great and mighty Realme, bordering towards the Eaſt vpon Ruſſia, and towards the South vpon the Eaſt Sea, called Mare Balticum, diuiding Swethland from Almanie and Pomernia, & towards the Weſt vpon Norway and Denmarke, and towards the North vpon Fiomark. Stockholme is the Metropoltan City in this Realme, wherein the King kéepeth his Court. From this Realme is tranſported into other Prouinces theſe Merchandizes, that is to ſay, Copper, Iron, Lead, coſtly Furres, Hides or Skins of Elkes, of Oxen, of Bucks, of Goates, Tallow, Tarre, Barley, Malt, Nuts and Filbirds, and ſuch like.

The deſcription of Muſcouia which ſhould follow next, is ſet downe in the third Table or Inſcription, which ſtandeth in the very front of the Table written in Latine, the interpretation whereof hereafter followeth in his place.

THe kingdome of Polonia contayneth Lituania, Podolia, the leſſer Ruſſia, Volhinia, Maſſouia, Samogitia, Pruſſia, and in a manner all Liuonia, which two laſt Prouinces did belong not long ſince to Almania. Polonia is bounded on the Eaſt with Muſcouia, & with the Tartaries perocopſiques, and on the South with Moldauia, and Hungaria, and towards the Weſt with Almania, and towards the North with the Sea Baltique, and Muſcouia

The

The chiefe Merchandizes that goe out of this Realme into other Prouinces are theſe, Wheat, Rie, & other Grain, Spruſe or Danske Béere, yellow Amber, Wax, Hony, a certaine drinke made of Hony which we call Mead, Hides of Oxen dryed and ſalted, Flax, Hempe, Pitch and Tar, Aſhes, Clauelloes, wood Mazier, and of Cuvelier, and other ſuch like Merchandizes.

HVngarie is a very fruitfull Realme, rich and mighty, and it is bounded on the Eaſt with Moldauia, and Valachia, & on the South with Boſnia and Croatia, and on the Weſt with Almania, and on the North with Polonia, It hath many Nauigable Riuers, wherein are great ſtore of fiſh, that is to ſay, Danubius, Dravus, Savus, & Tibiſtus. The chiefe townes are theſe, Buda, Gran, Weiſſenburgh, Rab, Prezburgh, Agria, Colocza & Belgrada. The Inhabitants of this Country are warlike and hardie, and haue béene long time heretofore a moſt faithfull Rampire and Bulwark to all Chriſtendome, but in the end by reaſon of their ciuill Wars, the better part of them haue béene ſubdued in our time, and are made moſt miſerable Slaues to the Turke.

The Merchandize which goe out of Hungary into other Prouinces are theſe, Gold, Siluer, Copper, and diuers ſorts of Colours, Salt, Wine, Wheat, Béefes, and freſh fiſh of the Riuer ſalted.

SClauonie is bounded on the Eaſt with Bulgaria, and Grece, and on the Southſide with the Gulfe of Venice, and on the Weſt, with the North part of Italie, and on the North ſide with Almanie and Hungarie. This Region contayneth many particular Prouinces, as Liburnia, Croatia, Boſna, and Dalmatia, yͤ chiefe Townes whereof are theſe, Raguza, Salona, Sabenica, and Zara. Sclauonie at this time is diuided into many iuriſdictions, for one great part thereof is ſubiect to the Turke, another part to the Emperour of Almanie, and the reſt ſituated vpon the Sea Coaſt is ſubiect to the Seniory of Venice. At this day there is no tongue (the Arabic tongue excepted) that extendeth further than the Sclauonic tongue, for as it is the Vulgar

tongue

tongue of Sclauonie, ſo is it familiar to them of Hiſtria, Bohemia, Morauia, Seleucia, Polonia, and to the large Prouinces of the great Duke of Muſcouia, Circaſſia, Perihoka, Georgiana, Mengrelia,Moldauia,Valachia, Bulgaria, Ruſſia, Seruia, Albania, and to part of Hungarie, it is alſo familiar in the Court of the great Turke, and among his Souldiers that ſerue in Aſia, and Afrique.

GReece, ſomtime the mother of all Science & Erudition: is on the Eaſt, South & Weſt ſide enuironed with the Sea, but on the Northſide it is bounded with Seruia and Bulgaria, it hath in times paſt valiantly fought with and beaten the Monarchie of Perſia, for the liberty of their Countrie, and finally by Alexander the Great hath triumphed ouer the ſame, & thereby erected the third Monarchie, by meanes whereof it came to paſſe that the Greeke Tongue was made common throughout Aſia, Syria, and Egypt, vntill ſuch time as the Saracens and the great Turke did corrupt and change the ſame. The Emperors did rule in Greece from the time of Conſtantine the great, vnto the yeare 1452. in which yeare Mahomet the great Turke forced the Towne of Conſtantinople, and aboliſhed the Empire of Greece, in ſuch ſort as euer ſince this magnificent and ſtrong Imperiall Towne of the Chriſtians, hath beene the ſeat of the Emperor of Turkie, and all the Country made Slaues to the Mahometanes.

The chiefe Merchandizes that come from this Country to other Prouinces are theſe, Gold, Siluer, Copper, Vitriall, diuers ſorts of Colures, Wines, Oyle, Veluets, Damaſke, Grograines, Turqueſques and Wood.

ENgland together with Scotland making both but one Ilãd is the greateſt and mightieſt of all Europe. And England is enuironed on all ſides with the Sea, ſauing on the Northſide, which bordreth vpon Scotland. The Aire according to the ſituation is indifferent temperate, for though it bee more Northward than Flanders, yet it is not ſubiect to ſuch hard froſts and cold Winters. The ſoile is very fruitfull, bringeth forth great plentie of Wheate and of other Corne, it hath great plentie of

fruit-

fruit-trees, and there be many large & faire woods, ſweet fountaines, floods & riuers full of fiſh, and a number of good hauens, alſo it hath many rich Mines, as of Gold, Siluer, Lead, Iron, and chiefly of fine Tinne, wherfore it may be worthily counted amongſt the moſt puiſſant & richeſt Ilands of the world. This Iland nouriſheth alſo a great number of cattell meete for mans vſe, and chiefly of ſheepe, which yeeldeth fine and good Wooll, in which, partly conſiſteth the profit and riches of the Countrie, in ſuch ſort, as the Golden Fleece ought to haue beene ſought for in this Iland, and not at Colchos. The inhabitants moſt commonly are tall of ſtature, beautifull and white of viſage, couragious and meet for war, alſo they are ingenious and ſtudious in the art of Nauigation, in ſo much as in theſe daies they haue traffique into very farre Countries, as into Greece, Natolia, Syria, Egypt, Barbarie, Muſcouia, and into many other Prouinces. London being ſituated vpon the Thames is the Metropolitan and chiefe Citie of this Realme, and the Staple of the trade of Merchandizes, and the Court Royall: but Cambridge and Oxford are Vniuerſities.

The Merchandizes ſent from England into other Prouinces are theſe, broad Cloathes, Carſies, Stamines, Bayes, Sayes, Saffron, Tin, Lead, Wheat, Barley, Malt, Beere, Red-Herring, Sea-cole, and Wood.

SCotland is the North part of this Iland, and is likewiſe inuironed round about with the Sea, ſauing on that ſide with which it bordreth vpon England. This Country is not ſo fruitfull as England, notwithſtanding it is ſufficiently prouided of all things that is needfull for mans nutriment, it is watred with diuers armes of the Sea, and is indued with many mountains full of graſſe, which ſerueth to feed their cattle. Edenburgh is the Metropolitan of this Realme, wherein the King keepeth his Court. The Scottiſhmen are good Souldiers, which can endure ſcarſitie and the iniuries of the Aire, and are very deſirous to winne honour. The Inhabitants of the South part thereof doe ſpeake the Engliſh tongue: but thoſe of the North, and thoſe of the Iles Hebrides doe vſe the Iriſh Tongue,

and

and thoſe of the Orcades doe vſe the Norway Tongue.

The Merchandizes which Scotland ſendeth to other Countries are theſe, courſe Clothes, Karſſes, Stamins, Freeſes, Wooll, Barly, Malt, Fiſh, Hides, Leaden Owre, and Smithes Cole.

The Contents of the fift Page.

IN this Page he deſcribeth Ireland, the Iles Azores, Corſica, Sardinia, Sicilia, Candia, Nigroponte, Stalimine, all which Ilands doe belong to Europe, and in the latter end of this Page he beginneth to deſcribe Aſia.

IReland is nigh vnto England and Scotland, and is very rich in meddow ground, and hath great plenty of Cattell, as well tame as wild, and Fiſh as well of the Sea, as of freſh Riuers, and great quantie of Fowle and Birds; but it hath ſcarcitie of Corne by reaſon of the great moyſtneſſe of the Aire. This Ile is free from all venemous beaſts, the Inhabitants are wild people, great and ſtrong, ſwift in running, and by little and little they wax euery day tamer then other, vnder the Gouernment of the Engliſhmen.

THe Iles of Azores, are called of the Flemiſh Pilots and Mariners the Flemiſh Iles, becauſe thoſe of Bruges were the firſt that diſcouered thoſe Ilands. And albeit that at this preſent the Inhabitants thereof are Portugals, there is yet a remnant of Flemiſh Families, as of the Bruines, of the Vltrickes and others. Theſe Iles are fruitfull, and bee nine in number, that is to ſay, the Iles of S. Mary, S. Michael, Tercera, Gratioſa, S. George, Pico, Fayal, Flores and Coruo.

Tercera amongſt all the reſt is the ſtrongeſt, and bringeth forth Dyers Wad. The Ile of S. Michael bringeth forth Sugar, and great abundance of good Dyers Wad.

Cor-

COrſica is ſituate in the Sea Mediterraneum; and bringeth forth moſt excellent Wines, rough Horſes, and great hunting Dogges: and this Ile is gouerned by the Genueſes.

SArdinia is a very fruitfull Ile, and chiefly of Wheate, which is tranſported from thence into Italie and into Spaine. Likewiſe it hath very good Wine, both red and white, and very good Salt, it hath alſo certaine Mines of ſiluer, but not of ſo profitable yeeld as in times paſt. The inhabitants are ſtrong, and are able to endure great labour and trauell, In great Townes they ſpeake the Spaniſh tongue of Aragon, but in ſmall Townes they ſpeake the vulgar tongue of the Ile.

SIcilia hath beene alwayes famous, and is called of Diodorus the Paragon of Iles, alſo the Greekes & Latines haue greatly celebrated this Ile in their writings. This Iland hath great abundance of Wheat and of all other Graine: Alſo of Wine, Sugar, Wax, Honey, Saffron, Silke, and of all things elſe appertaining to the vſe of man. Wherefore this Ile, together with Egypt, was ſometime called the Grange of the Romans. In this Iland is the hill Etna, which alwayes burneth. And in the Sea of Sicil nigh vnto Drepano, as Plinie writeth in his 32. Booke and ſecond Chapter, there groweth very faire redde Corall, in ſhape like to ſuch a tree or buſh as is here figured, which while it is vnder the water is greene & tender, but ſo ſoone as it commeth into the Ayre, it waxeth hard like a ſtone, and is red, there is found thereof alſo nigh vnto the Sea Coaſt of Prouince, alſo in Italie nigh vnto Monte alto, and to Naples, likewiſe in the red Sea, and in the Gulfe of Perſia, and there be three ſorts of Corall, that is, red, blacke, and white.

CAndia, ſometime called Creta, was in old time enriched with the famous Laborinth, and with a hundred Cities. It had alſo a great number of good ſhips and expert Pilots. This Ile together with others, as the Ile of Zante, Cephalonia, Corſue, and diuers others, be at this preſent gouerned by the Senat of Venice.

The

The Merchandizes tranſported out of Candia into other Prouinces are theſe, noble Wines, as Malmſey, Muſkadine, Corants, Graines of Scarlet, Sugar, Chriſtall of the Mountaine, Cotton, and Buck-ſkins.

NIgro-ponte, ſometime called Euboia, is a very fruitfull Ile in Wheat, Oyle and Wine.

STalimine ſometime called Lemnos, is an Ile which hath abundance of Wheate and moſt excellent Wines. In this Ile they digge out in the Moneth of Auguſt a certaine Medicinable Earth, called of the Phyſicians, Terra ſigillata. There be many other Iles beſides theſe in Europe, as in the Iles of Denmarke, the Iles of Zeland in Flanders, the Ile Frumentera, Iuica Maiorica and Minorica, and a number of Iles that are in Sclauonie and Greece.

ASia is ſeparaed from Europe, by the floudes Tanais & Dwina, and from Afrique by the narrow part of Land, which is nigh to Egypt, betwixt the Mediterran Sea, and the red Sea. Aſia farre exceedeth in greatneſſe both Europe, Afrique, and Peruana, and alſo in riches, as in Pearles of great price, and precious Stones, and Spices, it exceedeth all the other Countries of the World.

This Region hath beene alwayes renowned by the firſt and ſecond Monarchie of the World, obtayned by the Syrians and the Perſians, as alſo it is at this day by the mighty Princes of China, and of Perſia, and by the puiſſance of the Tartarians.

In this part of the World man was created of God, placed in Paradiſe, ſeduced by Satan, and redeemed by our Sauiour Ieſus Chriſt: and in this Region, were done in a manner, al the Hiſtories and Acts mentioned in the Old Teſtament, and a great part of thoſe in the New Teſtament. The moſt celebrated Prouinces of Aſia are thoſe that belong to the great Duke of Muſcouia, alſo Tartaria & China, the rich Prouince of India, as Guzarette, Corsſan, Sigiſtan, Chirmania, Parthia, Perſia, Media, Aſſyria, Armenia, Natolia, Syria, and Arabia. The principall Iles of Aſia are theſe, Iapan, Luconia, Mondanao, Borneo, Sumatra, Ceiland, and Cypres, for as for the Iles of Gilolo, Moluccas, Banda and Celebes, they belong to that part of the World which is called Magellanica.

The moſt mightie Potentates of Aſia are theſe, the King of China, the King of Perſia, the great Turke, and the Emperour of Ruſſia, otherwiſe called the great Duke of Muſcouia, according to which Seniories all Aſia is diuided into ſix parts, that is to ſay, the Aſiaticall Prouinces, belonging to the great Duke of Muſcouia 1. Tartaria 2. China 3. the Indies 4. the Prouinces of the King of Perſia 5. and thoſe of the great Turke 6. And as touching the Aſiaticall Prouinces of the Emperour of Ruſſia, and of the Prouinces of Tartaria, we ſhall make mention thereof heereafter, when wee come to tranſlate the Tables or Inſcriptions written in Latine, marked with the Numbers 3. and 4.

The Contents of the ſixth Page, wherein hee deſcribeth China, *and the Plant of Pepper there growing, with the ſhape thereof.*

CHina or Sina is the third part of Aſia, ſometime called of Ptolomy, Sinarum regio, which on the Eaſtſide is enuironed with the Sea called of the ancient Geographers Oceanus Siricus, or the Eaſt Ocean, and on the Weſt it is bounded with the Indies and with Brumas, and on the North with Tartaria. This Country is for many cauſes eſteemed to be the moſt ample, the richeſt and moſt mighty Realme of all the World, for it extendeth from the 18. degree to the 55. degree of North latitude, and it contayneth in longitude 450. leagues of Almanie, and it is diuided into 15. great Prouinces or Realmes, that is, Quincij, otherwiſe called Paquin, Xanton, Xiancij, Sancij, Suchuan, Honao, Nanquij, Chequiam, Foquiem, Cantam, Quancij, Suinam, or Huinam, Quiecheu, Fuquam, or Huccquam, and Quiancij. This Realme is adorned with many Nauigable Floudes, & full of Fiſh, it is very fruitfull ſull, and bringeth forth great abundance of all kind of Graine, and amongſt the reſt, of Rice, euery yeare thrée or foure times in a yeare. It hath goodly woods and forreſts, wherein doe kéepe a number of wild Boares, Foxes, Hares, Conies, Sables, and Martins. The mountaines are full of graſſe, ſeruing to féed infinite heards or troops of Cattel, both great and ſmal. There be alſo many mines of precious ſtones, of Gold, Siluer, Copper, Stéele, and Iron, and a great number of Pearles, but not very round, and great abundance of ſilke. The townes there are very great, fortified, and well peopled, which is eaſily knowne by the greatneſſe of Cantan, which is one of the leaſt Metropolitan Cities of the Realme, and yet it containeth in circuit 12. Italian miles, and 350. Geometrical parts, which is more then foure houres iourny, not reckoning the ſuburbs, which are very large and full of people. The principall Metropolitan towne where the King kéepeth his Court, is named Paſquine or Suntie, that is to ſay in their tongue, the Celeſtial or Heauenly City: touching the greatneſſe whereof, the Portugals and the Caſtilians doe write many incredible things, and according to the opinion of many, it is the ſelfe ſame towne which Marcus Paulus Venetus calleth Quinzay, as ẏ which hath diuers names in diuers languages. The like may be ſaid of a towne in Flanders, which the French men call Lile, the Flemings Ruſſill, and in Latine it is called Inſulę. In theſe Prouinces be many good Ports and Hauens vpon the Sea, & a great number of ſhips, by reaſon whereof the Inhabitants are moued to ſay, that amongſt them, there are as many that dwel in ſhips vpon the Sea, as be of them that dwell in houſes vpon the Land, and that their King might eaſily make a bridge to paſſe from China to the towne of Malaccha, which is diſtant from thẽ 300. Almaine leagues. But aboue all there is one thing worthy of great admiration, & that is a wall which hath in length 400. Spaniſh leagues, which the King of China cauſed to be built, to defend the Countrie againſt the inuaſion of the Tartarians, of which thing if ẏ anciẽt men had had any knowledge, they would haue counted this worke among the ſeuen wonders of the world. The inhabitants are men of ſpirit, and giuen to labour. There was alſo inuented by them ſuch a kind of writing, that euery man of what nation ſoeuer he were, being ſomewhat exerciſed therein might pronounce in his Mother Tongue, euen as it were ciphered. They inuented alſo certayne Chariots, wherein they might ſayle by the Wind vpon plaine ground, as they doe in ſhips vpon the Sea: There are alſo men amongſt them that are well learned in all Sciences and eſpecially in Architecture, wherein they excell all others. Moreouer, they are great Louers of Learning, and thoſe that doe excell others therein are promoted to the moſt honorable Eſtates: they haue good Municipall Lawes, and will ſuffer no Stewes, and they forbid that any man ſhall marrie any woman with whom he hath liued before in adultery, and they grieuouſly puniſh all offences, and doe forbid idleneſſe as the Mother of many euils, yea they doe conſtrayne blinde men to get their liuing, by turning with their Hand-mils made to grinde Corne, or any other things, and in their wars againſt the Tartarians, they get the victorie more by fine pollicy & ſtratagems, and by multitude of people, then by proweſſe or feats of Armes. The Portugals doe report that the King bringeth to the field 3000|000. footmen, and 200|000. Horſemen. Now as touching their Religon they be Paynims and Superſtitious Idolaters, ſauing that there are in many places ſome Chriſtians, as Marcus Paulus Venetus teſtifieth.

The chiefeſt Merchandizes tranſported out of China into other prouinces are theſe, Gold, precious ſtones, Pearles, Muſk, Rubarbs, the medicinable root, China Purſlane, abundance of Silke, Sugar, Rice, and all ſorts of Graine. The plant of Pepper is ſowne at the roots of other Trées, but ſpecially at the root of that Indian Trée, which is called Faufell, and at the root of the Date trée, to the tops whereof it climeth vp, much like as Iuie doth vpon a trée, or like to that which is called in latin Clematis in Engliſh Perwinkle, which will wind about euery hearbe that groweth nigh it, the root is but ſmall, and his leaues thin, like vnto Citron leaues, but ſomewhat leſſe, and ſharpe pointed, gréene and byting in the taſte, the graines do grow nigh one to another, like the long Grape, and are alwayes gréene vntill they be through ripe and dry. There be two kinds thereof, that is, white and blacke, but the Plants of both are much like to our white and red Wines. Pepper groweth in places neere the Sea ſide of Malacha, and in the Iles of Sunda and Cuda, ſituated nigh vnto the Ile Iaua Maior, but the beſt kind of Pepper moſt plentifully groweth in the Prouince of Malabar, betwixt the Cape Comori and the Cape Canonar, but long Pepper is found in the Realme of Bengala, and is another kind of Plant, altogether vnlike to this.

The contents of the ſeuenth Page, wherein he firſt deſcribeth the red Figge Tree of India, and ſetteth downe the ſhape thereof, then he deſcribeth the Eaſt Indies, and laſt of all he ſheweth the nature of the Elephant, whoſe ſhape hee ſetteth downe in the ſame Page.

THe Indian Fig-tree groweth round about Goa, the body thereof is high and great, & extending his branches in a round forme, which like yellow or golden fillets doe ſtoope downe towards Earth, and ſo ſoone as it toucheth the Earth, it bringeth forth a new Generation of trees, which differeth nothing at all from the Mother, but onely in thicknes, des Souches, and the branches of thoſe doe bring forth new trees in like manner, in ſo much as the Mother with her Off-ſpring, will in ſhort time ſpread as much ground as contayneth an Italian myle in circuit, the fruits are ſmall Figs, and red as bloud, as well without as within.

India tooke his name from the floud Indus, which bordereth towards the Eaſt vpon the Realme of China, and towards the South vpon the great Ocean of India, and towards the Weſt vpon the Sea of Arabia, and alſo vpon the floud Indus, and towards the North vpon the Sea Mare Exinum, or Mare maior, and vpon Bramas.

This Countrie is iudged at this day, as it hath beene long ſince, to bee the Nobleſt and Richeſt Country in all the whole World, and it is diuided by the Floud Ganges into two parts, whereof the Weſt part is called Indoſtan, or India intra Gangem and the Eaſt part is called India extra Gangem, and it contayneth many Prouinces & Realmes, as Cambaiar, Delli, Decan, Biſnagar, Malabar, Narſingar, Orixa, Bengala, Sanga, Mogores, Tipura, Gouros, Aua, Pegua, Aurea, Cherſoneſus, Sina, Camboia, and Campaa. Theſe Prouinces are watred with a number of goodly Riuers, amongſt the which Indus & Ganges are the moſt renowned Riuers of the World. Moreouer, theſe Prouinces do abound in all things that may grow either within the Earth or vpon the Earth, except it be Copper and Lead, as Plinie affirmeth, alſo all manner of plants that grow there are very great, braue and excellent good. India exceedeth all other Countries in precious ſtones and in Spices, furniſhing therewith almoſt all the World. It hath many rich Mines of Gold, and great ſtore of faire Pearle, alſo great multitude of all manner of Cattell, Horſes onely excepted, which are brought thither out of Perſia and Arabia. It is not long ſince that Callicute was the chiefe Towne of Merchandize in India, but at this preſent Goa is the chiefe: there is alſo great traffique vſed at Dio, at Cananor, at Cochin, at Bengala, at Pegu, at Malacha, and at Sian.

Of the Elephant.

THe Elephant amongſt all other foure-footed beaſts, is the greateſt ſaue the Dragon and the Crocodyle, he is very ingenious, in ſo much, as it is incredible that which the Ancient men write of him, and alſo the moderne, which haue ſought more diligently to know his nature and diſpoſition, hee is of force incredible, and meet to draw Ships and Boates both out of the water and into the water, and to draw Artillery and Ordinance, he is alſo meet for the War, his teeth that ſhoot out of his mouth are Iuorie, there is great number of them found in the Indies, and in Afrique, but the greateſt and fitteſt for War are found in the Ile of Ceiland, nigh to Calicute.

The Contents of the eighth Page, in which hee deſcribeth the Beaſt called Rhinoceros, and ſetteth downe his ſhape, and he deſcribeth the Sinamon Tree, ſhewing the ſhape of the trunke and of the leafe thereof, and alſo the Muſke Cat with her ſhape, and in the latter end of the Page he deſcribeh the Realme of Perſia.

THe Beaſt called Rhinoceros, is as long and as large as the Elephant, but not ſo high, for his legs are ſhorter, hee is armed not like a Tortiſe (as Plancius ſayth) for that is couered all ouer with one ſhell, whereas this Beaſt is armed with manifold ſtrong, hard, and thicke Skales, which are yellow and ſpotted with Purple, he hath a ſtrong Horne or Bone vpon his Noſe, whereof he taketh his name, and hee hath another little Horne vpon his backe, and hee is a great enemie by Nature vnto the Elephant, hee is found in the Realmes of Cambria and of Bengala.

The Sinamon Tree.

THe Sinamon Tree, is as bigge as the Oliue Tree, the branches and grafts whereof are very right, his leaues in colour are like to thoſe of the Lawrell Tree, but in ſhape like to thoſe of the Citron, his Flowers are white, and the fruites thereof are blacke and round, like a hazell Nut, the Sinamon it ſelfe is no other but the barke of the ſayd tree, which groweth in the Prouince of Malabar, and in the Iles of Iaua and Mindanao, but the beſt is found in the Ile of Ceiland.

The Muske Cat.

THe Muſke Cat, is like in ſhape to a common Cat, but ſhe is greater than either Cat or Fox, her muzzel is ſomwhat long and armed with ſharpe teeth, and with harſh haire, which haires, (being angry) ſhe will ſet vp as a Swine doth his briſtles, ſhe is in colour like a Wolfe, but that ſhee is ſpotted with

blacke

blacke ſpots, the nether part of her Muzzell, and the haires of her beard are white, her feet are blacke, her flankes are whitiſh, and doe wax whiter and whiter towards her belly, and next to her Genitories, ſhee hath a little bag like to a bladder or purſe, into the which doth fall the precious greace or humour which they call Ciuet and Zibeth, which Ciuet is gathered out from thence with a ſpoone, if ſhe be in mans keeping, but when ſhe is abroad and at her owne liberty, her bag being full, ſhe will voyd that Ciuet of her ſelfe, and it will yeeld ſuch a ſweet ſauour, as all they that ſayle by that Coaſt may ſmell it a far off, as I haue heard. Theſe Muſke Cats are brought from the Realmes of Pegu and Tarnaſſary.

The deſcription of Perſia.

AS thoſe in Perſia haue enioyed in times paſt the ſecond Monarchy of the World, ſo at this preſent they be ſtill very mightie, for the King of Perſia is one of the greateſt Potentates in the whole World, as hee which commandeth all the great Prouinces that doe border towards the Eaſt vpon the Floud Indus, and towardes the South vpon the Sea called Mare Caſpium, and vpon the floud Oxo, within which limits are comprehended all the greateſt Realmes and Lands, which the ancient Geographers were wont to call by theſe names, Aſſyria, Media, Suſiana, Perſia, Parthia, Hircania, Margiana, Bactriana, Paropaniſa, Aria, Draugiana, Arachoſia, Caramania, and part of Armenia maior, the which at this preſent are called by other names as you may ſee in the Map.

The Perſians are a hardie and warlike people, and thought to be yͤ beſt riders or horſemen in all the World, they haue very hard wars with the Turkes, they be of moſt free and gentle Nature, louers of ciuilitie, they make great account of Learning and Sciences, they honour Nobility, wherein they greatly differ from the Turkes. Now as touching their Religion they bee Mahometiſts, and yet in ſuch ſort, as both they and the Turkes doe count each one the other, as Heretiques in that Religion.

From the Prouinces of Perſia are tranſported into other

parts

parts of the world theſe Merchandizes, ſtones, called Turqueſſes very faire and excellent pearles, great quantity of Silk, Veluet, Damaſke, Armour, & a great number of moſt excellent Horſes.

The Contents of the ninth Page.

IN this Page he deſcribeth and ſetteth downe the ſhape of the precious ſtone, named Bezar, and the Dominions of the great Turke in Aſia, and the City Aden in Arabia, alſo he deſcribeth the beaſt called Camelopardalis, and ſetteth downe his ſhape, alſo he ſetteth downe the ſhape of three of the greateſt Pyramides that are in Egypt.

Of the ſtone Bezar.

THe ſtone Bezar or rather Pazar (for that is his right name) groweth in Perſia in manner de Boucz, named Pazan, which are of diuers colours, but moſt commonly red.

The ſtone Bezar groweth in a concauitie, in manner of a Girdle, about two handfull long, and three inches broad, it is medicinable, and of great efficacie againſt all manner of Poyſons and Venoms, and many other Maladies: there is to be found of them in the entry of Malcha and alſo in Pegu, but the beſt of them are in Perſia.

Of the Dominions which the great Turke hath in Aſia.

THe great Turke doth poſſeſſe in Aſia, Natolia, ſometime called Aſia minor, and almoſt all Armenia, Meſopotamia, called at this preſen Diarbach, or Diarbekir, Syria, and a great part of Arabia, the moſt notable Merchant Townes of this Country are theſe, Trapezunda, Aleppa, and a Port vpon the Sea called Tripoli, alſo Aman Damaſco, with his Port Barutti, and Mecha.

The Merchandizes that are ſent from theſe Prouinces into other Countries are theſe, great quantitie of Silke, Veluet, Damaſke, Turkie Carpets, Cotton, and graine of Skarlet.

The Citie Aden.

ADen is the chiefe Merchant Towne of the vpper part of Arabia, which is gouerned by diuers Kings, and this Towne ſendeth into other Prouinces of the faireſt Pearles, the true Balme, Frankincenſe, Mirrhe, and Horſes.

The Beaſt called Camelopardalis.

THis beaſt is called of the Arabians, Gyraffa, but the name Camelopardalis is compounded of Camel and Pardale, which is a Leopard, he hath a very long neck like vnto the Camell, and is ſpotted with many ſpots, as is the Pardale or Leopard, he is a faire beaſt, and of gentle nature as the ſheepe, his head is like vnto the head of a Hart or Stag, but greater, his hornes are ſmall topped, and couered with haire, and are about a handfull and a halfe long, he hath eares, tongue and feet, like to an Oxe, his fore-legs are long & tall, & his hinder legges are ſhort, whereby he ſeemeth alwayes to ſtand right vp, his head is ſomewhat higher than the Camell, and this beaſt is to be found in Arabia, Æthiopia, and India.

The Pyramides.

IN Egypt are many Pyramides, whereof the two greateſt are counted amongſt the ſeuen wonders of the world, the greateſt of them (as witneſſe Peter Belon) who moſt diligently viewed the ſame, is at the foot foureſquare, and euery ſquare contayneth in length 324. paces, and in hight 250. degrees or ſteps, and euery ſtep hath in breadth 45. inches, which is three foot and 9. inches, but hee ſetteth not downe what depth euery ſtep hath, which muſt not be ouer deepe: for then how can any man eaſily mount vp to the toppe thereof, for hee ſaith it is playne in the toppe, and ſo large as 50. Perſons may ſtand thereon.

It is found by writing that 360|000. men wrought 20. yeares in building this Pyramides.

The ſecond great Pyramides, is ſomewhat leſſe and ſmooth on the out-ſides, without any degrées or ſteps, and the top thereof is ſharpe-pointed.

The Contents of the tenth Page.

IN this Page he deſcribeth the Crocodyle, and ſetteth downe the ſhape thereof; ſecondly, he ſheweth whereof the Mummy is bred. Thirdly, he deſcribeth the Vnicorne, and ſetteth downe his ſhape.

The Crocodyle.

THe Crocodyle is found in Egypt, in the floud Nilus, and in India in the floud Ganges, and in the two prouinces Mexicana and Peruana in many Riuers. This is a foure footed beaſt, which hath a horrible head, ſharpe téeth, a very ſmall tongue, & a thicke tayle, and his ſkin is hard and armed with hard ſcales, the nether part of his mouth is immoueable, and the vpper part moueable, contrary to all beaſts, he doth deuoure both men and beaſts, and doth kéepe more in the water than on the Land, and that which is greatly to bee wondred at, hee is ingendred of an Egge, as great as a Gooſe Egge, and hee groweth by little and little vntill he come to the length of 18. Cubits, or as ſome ſay, 22. Cubits, which maketh 33. foot.

Of Mummie.

MVmmie is made of bodies embalmed, which they bring from Egypt, whereas many ſuch embalmed bodies were buryed, about foure houres Iournie beyond Cayre, whereas was ſometime the great Citie of Memphis, for before the Natiuitie of Ieſus Chriſt the Egyptians being Paynims, did ſpare no coſt to kéepe the bodies of their Parents from putrifaction, and therefore they are great palpable lies, wherby fooles are perſwaded, that the Mummie procéedeth of thoſe bodies which doe periſh in the ſands that be in the deſerts of Arabia, as though it were poſſible that thoſe bodies could be preſerued in thoſe ſands, whithout ſtench or putrifaction.

Of the Vnicorne.

THe Vnicorne, as Lewes Vertiman teſtifieth, who ſaw two of them in the towne of Mecha, is of the height of a young horſe or colt, of 30. moneths old, which is two yeares and a halfe old, he hath the head of a Hart, and in his forehead he hath a ſharpe pointed horne thrée cubits long, he hath a long neck, and a maine hanging downe on the one ſide of his necke, his legges are ſlender as the legges of a Goat, and his féete are clouen much like the Goat, his hinder féete are hairy, and his haire in colour is like to a bay horſe. This beaſt in countenance is cruell and wild, and yet notwithſtanding mixt with a certaine ſwéetneſſe or amiableneſſe. His horne is of maruellous great force and vertue againſt venome and poyſon. The Vnicorne is found in Æthiopia, like as the Indian Aſſe is found in India, which hath likewiſe one onely horne in his forehead.

The Contents of the 11. Page, wherein he firſt deſcribeth Afrique, *and then certaine fruits and ſpices, as Nutmegs, Mace, and Cloues, and ſetteth downe the ſhape of them, then he ſheweth which be the mightieſt Princes in* Afrique, *and thirdly he deſcribeth* Mexicana, *which is the firſt North part of* America.

AFrique being the third part of the world, is ſeparated from Europe and Aſia, by the Sea Mediterraneum and the redde Sea, and by the land ſtraight which is betwixt Ægypt and Paleſtina, the chiefe Prouinces of Afrique are theſe, Ægypt, Barbaria, Biledulgarid, Sarra, Æthiopia, Nubia, the large Prouinces of the Abaſſines, falſly called the land of Preſter Iohn, and alſo Monomotapa. The moſt renowned Iles belonging to Afrique are theſe, Socotora, Madagaſcar, S. Thomas, the Iles of Capo Verde, and the Iles of Canarie and Madera.

The Nutmegge tree.

THe Nutmegge trée groweth in the Ile of Bada, and differeth not much from the Peach trée, ſauing that the leaues of the Peach trée are ſhorter and rounder: The fruit is couered with a thicke barke or huſke, which when it is ripe cleaueth in ſunder, and ſheweth the Nut together with the ſhell, which is couered with Mace, the which at the firſt view is as redde as Scarlet, and pleaſant to behold, but when the Nut waxeth drie, the Mace to ſeuer from the Nut, and looſing by little and little their Scarlet colour, doe waxe nigh vnto the colour of an Orange.

Of the Cloue tree.

THe Cloue tree groweth in the Iles of Moluccas, which in greatneſſe and ſhape is like vnto the Lawrell tree, ſauing that the leafe thereof is ſomewhat narrower. It hath many branches, and a great number of flowers, firſt white, afterward gréene, and then red, but being dried, they become blacke. The Cloues do grow vpon the outermoſt ends of the branches, one hard by another, and whileſt the flowers are gréene, they excell all other flowers in ſweete odour.

The chiefeſt Princes of Africa.

THe moſt puiſſant Princes of Afrique are theſe, the Emperour of the Moores or Ethiopians, which of the Arabians and of the Mahometiſts is called Aticlabaſſi, and of his owne ſubiects, he is called Acegue, and Neguz of the Abaſſines, that is to ſay, Emperour and King of the Abaſſines and Moores. Then the King of Monomotapa, the King of Morocho, the King of Fez and Sus. The great Turke alſo poſſeſſeth many Prouinces in Afrique.

The

The chiefeſt Marchandizes that come from Afrique into Europe are theſe, Gold, Iuory, wood of Ebony, Aloes, Baulme of Ægypt, Mummie, Mirrhe, Anill feathers, Sugar, Ginger, Dates and Wines of Madera, and of the Ile of Canarie.

Mexicana.

MExicana which is the fourth part of the world, is on all ſides enuironed with the Sea, ſauing that nigh vnto Nombre de Dios it is ioyned by land ſtrait to Peruana. The chiefe Prouinces of Mexicana are theſe, the Prouince of Mexico, otherwiſe called noua Hiſpania, terra Florida, Norum Bega, noua Francia, Eſtotiland, Saguena, Chilaga, Toconteae, Marata, California, Tolm, Qui vira, Agama, and Anian. The chiefeſt Iles lying on the North and Northeaſt part of Mexicana are theſe, Groynland, Crockland, Iſland, Frezland, Bacalaos, and Cuba.

The chiefe Marchandizes that come from Mexicana into Europe are theſe, Gold, Siluer, Pearles, Cochenilles to die with, Baulme, Salſaparillia, the roote Mechoicana, Brimſtone, hides of Oxen and Molne.

The Contents of the twelfth Page.

IN this Page he firſt deſcribeth the beaſt called in that tongue Aiotochli, in Spaniſh Armadillio. Then he deſcribeth the two Prouinces, Peruana, and Magellanica, then hee ſheweth which bée the moſt mighty Princes of the world, and finally the diuers qualities of the people inhabiting the world.

THe beaſt Armadillio is found in the Realme of Mexico, and he is no bigger then a Cat, he is headed like a Swine, and hath the féete of a Heriſon, and a long tayle, he is armed with ſcales, whereof he taketh his name, he kéepeth for the

moſt

moſt part within the ground, and as ſome ſuppoſe, doth liue by the earth, by reaſon that he is neuer ſeene to eate abroad out of his denne, the bones of his taile are medicinable, and doe remedie the paine and deafeneſſe of the eares.

Though Plancius ſaith that this beaſt is armed with ſcales, yet my countriman William Greenway, who is a proper ſeruitour both by Sea and Land, and hath béene in the Weſt Indies, and hath eaten of this beaſt, affirmeth his fleſh to be white and very delicate, and that he hath no ſcales, but that his ſkinne is white and ſmooth like to a pig new ſcalded, and that ſometime he will ſhrink vp the ſkin vpon his back into diuers plates, and ſpecially towards his fore parts and hinder parts, in ſuch ſort as he will make them almoſt to méete, and the former plaites do hang downe vpon his ſhoulders like vnto two Poldrons, and his haire is white and ſhort growing thin, héere and there one, and he is eared & tailed like a Rat, euen as he is here portraid, ſauing that he is throughout of one ſelfe colour, and without ſcales.

Peruana.

PEruana being the fift part of the world, is alſo inuironed on all ſides with the ſea, ſaue whereas the foreſaid landſtrait doth ioyne the ſame to Mexicana, & the chiefe prouinces which it containeth are theſe, Braſilia, Tiſnada, Caribana, Carthagena, Peru, Charchas, Chili, Chica, & the land of the Patagones. The moſt renowned Iles are theſe, Hiſpaniola otherwiſe called S. Domingo, Boriquen, and Margarita, which is the Ile of Pearls.

The Marchandizes which are tranſported out of Peruana into Europe, are theſe, Gold, ſiluer, Emeralds, Pearls, the medicinable ſtone called Bezoar, Baulme, Ginger, Suger, Wood of Braſill, Wood of Guaicum called Lignum vitæ, long Pepper, Pepper of Braſill, Caſſiaſolutiua, and hides of Oxen.

Magellanica.

THis is the ſixt part of the world, which as yet is but little knowen, in ſuch ſort as we cannot write any thing touching the Prouinces of the ſame, notwithſtanding it is thought ẏ the

pro-

prouince of Beach very rich, and hath aboundance of Gold: the chiefe Iles of Magellanica are theſe, Iaua maior, and Iaua minor, Timor, Banda, the Molucques, Romeros, the Iles of Salamon.

From the Ile Timor doth come into Europe, the white and pale medicinable ſimple called Sandalum.

From the Iles Banda doth come Nutmegs and Maces.

And from the Iles Molucques Cloues.

Which be the great Princes of the World?

THe moſt mighty Princes of the world are theſe fiue, that is, the King of China, otherwiſe called ẏ great Cham. 1. the King of Perſia, 2. the great Turke, 3. the Emperour of Æthiopia, 4. the Emperour of Ruſſia, otherwiſe called the great Duke of Muſcouia, 5. amongſt which the King of China, as a Pagan or Heathen, and the great Turke and the King of Perſia are Mahometiſts: but the Emperour of Æthiopia and the great Duke of Muſcouia doe make profeſſion of the Chriſtian Religion. Now as touching the King of Spaine, his puiſſance ſhould be much greater than it is, if his Prouinces were not ſo ſeparated, and ſo farre diſtant one from another.

The qualities of diuers people in the world.

AS touching the qualitie of people, though God Almighty hath created all men of one ſelfe bloud, and that all doe take their beginning from the Arke of Noah, and that all men be of one ſelfe quality & ſhape of bodie, yet they differ in greatneſſe, in proportion of members, and in colour: for the Paragones doe excéed all other creatures in greatneſſe. Againe, the men of China haue moſt commonly broad faces, little eyes, flat noſes, and little beards, and thoſe that haue ſmalleſt féete, are counted amongſt them to be moſt beautifull, thoſe of Africa haue groſſer and thicker lips than other people, the inhabitants of Agyſimba, and of Guinea, and ſpecially of the lands that be nigh vnto Cape de bona eſperanza, are blacke, from whom the Orientall Indians doe not much differ.

The

The Abaſſines or Mores of Ægypt, be of a duſkiſh colour like to the Oliue, the Inhabitants of Barbarie be called white Mores, and thoſe that dwell betwixt them and the Nigrites, or black Mores, be of a yellowiſh colour, the Spaniards haue not found either in Mexicana, or in Peruana any Nigrites or blacke Mores, but only in certaine villages nigh vnto Carque, the other nations vnder the hot Zone, be of colour browne bay, like a Cheſnut, & the nigher that they dwell to eyther of the Poles Arctique or Antarctique, the whiter moſt commonly they be, and as touching the reſt, all are like in qualities, ſhape and faſhion of body, as hath béene ſaid before, wherfore they are méere lies that are wont to be told of the Pigmeans, in that they ſhould be but a fóot and a halfe high, and likewiſe that which hath béene ſpoken of people, that ſhould haue their heads, their noſes, their mouthes, and their eyes in their breaſts, or of thoſe that are headed like a dogge, or of thoſe that haue but one eye, and that in their forehead, or of thoſe that haue but one foot, and that ſo great as that it couereth and ſhadoweth all their body, or of thoſe that haue great eares hanging downe to the ground, All thoſe are méere lies, inuented by vaine men, to bring fooles into admiration, for monſters are as well borne in Europe, as in other parts of the world.

NOw in the foure pages following, he ſetteth downe in the French tongue an interpretation of the Latine inſcriptions diſperſed throughout the Map, euery which inſcription hath his number added, which I doe alſo héere ſet downe in the ſame order, ioyning to euery number his Lōgitude & Latitude, to the intent you may the more eaſily find out the ſaid inſcriptions, of which inſcriptions there be in all 71. diuided into fiue parts, wherof the firſt part containeth 21. inſcriptiōs belonging partly to Europe, but the moſt to Aſia, the ſecond part containeth 12. inſcriptions belonging to Afrique, the third part containeth 11. inſcriptions, belonging to Mexicana, the fourth part containeth 6. inſcriptions, belonging to Peruana, and the fift part containeth 21. inſcriptions, belonging to Magellanica.

The

The twenty one inſcriptions belonging to Europe, but moſt to Aſia, doe heere follow.

The number of inſcrip.	Longitude.	Latitude.	North or South.
1.	5.	85. 30'.	North.

THis arme of the Sea doth take his courſe through thrée places, running continually towards the North Pole, and is frozen thrée moneths of the yeare, and it containeth in breadth about 37. leagues.

2.	38. 0'.	86. 30'.	North.

It is ſaid that this Countrey is inhabited of Dwarffes, called in Latine Pigmei, being in height foure foote as thoſe be of Groynland, which are called Sereelings.

3.	81. 0'.	77. 0'.	North.

Muſcouia is bounded on the North ſide with the Sea Pitzorique, called of the ancient Geographers Mare Glaciale, that is, the frozen Sea, and towards the Eaſt it bordereth vpon Tartaria, and towards the South vpon the Sea called Mare Caſpium, and alſo vpon the Turkes, and Tartaries Perocopſiques, and towards the Weſt, it bordereth vpon Lituania, Liuonia, and vpon the Realme of Swethland: as touching their Religion, they obſerue the faith and ceremonies of the Gréeke Church, all their Biſhops are called in their language Vſadiques, and alſo their Metropolitans are vnder the obedience of the Patriarch of Conſtantinople. The people is wiſe and ſubtill, and yet louing ſeruitude more than libertie or fréedome, and they all confeſſe themſelues to be the ſeruants or ſlaues of the great Duke, hauing ſeldome or neuer peace, for either they haue wars with thoſe of Lituania, or with thoſe of Liuonia, or with thoſe of Swethland, or with the Tartarians, or if they haue no warres, then they lie in garriſon nigh vnto the 2. flouds Tanais & Dwina, to defend their bounds from the depredations & inuaſions of the Tartaries, they ſharpely puniſh robbers & ſtealers, and yet priuie theft & murder is ſeldome puniſhed with death: their ſil-

uer

The number of inſcrip.	Longitude.	Latitude	North or South.

uery money is not round, but hath the forme of an egge, their country is euery where full of woods, and they haue great aboundance of rich furres, they ſend into all countries of Europe very good Flaxe and Hempe to make Cables and Ropes, and a great number of hides, as well of Oxen as of Elks, great bals of Waxe, much ſalted fiſh, and Whales greaſe. The great Duke, called of his ſeruants the Emperour of Ruſſia, is rightly accounted amongſt the moſt mighty Monarchs of the world.

4	98.0'.	80. 0'.	North.

This arme of the Sea hath fiue mouthes or entries, and by reaſon that it is ſo ſtraight, and hath ſo violent a courſe, it is neuer frozen.

5.	123.3'0.	58. 0'.	North.

Vnder the name of Tartarie at this day are comprehended all the prouinces that border towards ẏ Eaſt vpon the ſea of China & towards the South, are limited with the prouinces of China, of India, with the floud Oxio, with the ſea, Mare Caſpium, & with the lake or Mariſh called Palus Meotis, & towards ẏ Weſt they are bounded with the floud Boriſthenes, & with ẏ limits of Muſcouia: for ẏ Tartarians haue cōquered all the countries which they poſſeſſe at this preſent, ſo as Tartary comprehendeth al that country which the Ancient were wont to cal Sarniacia Aſiatica, and alſo the Scythias, that is, intra Imaum and extra Imaum, they beganne firſt to be renowned in Europe, in the yeare of Chriſt 1212. The Tartarians are diuided into certaine commonalties, and Colonies, called of them Hordes, but for ſo much as they dwell in diuers prouinces, that do extend farre, & be farre diſtant one from another, they differ alſo in their maners & trade of life, they be men of a ſquare ſtature, hauing broad and groſſe faces, their eyes hollow ſunke into their heads, & looking ſomewhat a ſquint, & thick beards, they be ſtrong of body and hardy, they eate horſes, and all other beaſts, howſoeuer they are ſlaine, ſauing hogs, from which they abſtaine, they are able to endure hunger, thirſt, watch, and all diſcommodities, & when they are diſtreſſed in their voyages with hunger and thirſt, they let their horſes bloud, & with that bloud quench their hunger and thirſt, which kinde of meat they cal in their language [illegible], they call their Emperour Cham, that is to ſay, Prince; and therefore Cambalu is interpreted to be the ſeat or towne of the Prince.

The number of inſcrip.	Longitude.	Latitude	North or South.
6.	125. 4'0.	50. 0'.	North.

This round lake in the Prouince of Sancii, tooke his firſt originall & beginning in the yeare 1557. by reaſon of an inundation or floud, which carried away 7. townes beſides villages, and other places nigh adioyning, and a great multitude of people, whereof none were ſaued, but only one infant, ſitting vpō a tree.

7.	124. 0'.	37. 0'.	North.

The Inhabitants of China, are of good ſpirit and ingenious, inſomuch as they haue inuented certaine kind of carts, wherin they may ſaile vpon euen ground, hauing winde, and ſaile as they doe in ſhips vpon the Sea.

8.	171. 3'0.	80. 3'0.	North.

Plancius in this inſcription ſetteth downe ẏ opinion of Mercator, touching the beginning of Longitude, and touching the Adamant ſtone, otherwiſe called the Loadſton, in Latine Magnes. Francis of Diep, a moſt ſkilful Pilot, doth witneſſe that the needle of ẏ Mariners compaſſe, doth turn directly to the North Pole, being in the Ilands of Capo Verde, that is to ſay, the Ile of Sal, the Ile of Bonauiſta, and the Ile of Maio, wherevnto thoſe doe agree very nigh, which doe ſay that the needle doth the like in the Iles of Tercera, and of S. Marie, which are part of the Flemiſh Iles, otherwiſe called the Azores: but ſome others doe affirme, that the needle ſheweth the North Pole beſt, being in the Ile of Coruo, which is the furtheſt Ile weſtward of the ſaid Azores, And becauſe ẏ Longitude of places by moſt likely reaſons, ought to take his beginning from the common Meridian of the world, and from the Rocke or Pole of the Adamant ſtone,

The number of inſcrip.	Longitude.	Latitude.	North or South.

we here following the opinion of thoſe that are moſt ſkilfull in this matter, haue ſet downe the firſt Meridian betwixt the Iles of Capò Verde, and the Azores, and becauſe the needle in all other places declineth either more or leſſe from the Pole of the world, there muſt needs be another Pole in ſome one place, whereunto the needle doth incline from all coaſts of the world, and I haue found by the declination of the needle obſerued at Ratisbone, otherwiſe called Regensberg, that is the ſame place, which I haue ſet downe in the Map, and I haue likewiſe marked in this Card the ſituation of the Pole of the ſtone, in reſpect of the Ile Coruo, to the intent that according to the outermoſt places limited by the firſt Meridian, the outermoſt bounds betwixt which this Pole ought to be found, might be knowne, vntill the diligent and curious conſideration of the Pilots ſhall bring vs ſomething of more certaintie. Thus farre Mercator.

9.	162. 0'.	71. 0'.	North.

Theſe are the plaine fields of Bargu, whereof the inhabitants are called Mecrit.

10.	155. 30'.	68. 0'.	North.

The mount Aſkai, in which are to be ſeene the Sepulchers of the Kings of Tartary.

11.	171. 30'.	70. 0'.	North.

Vpon this Mountaine are ſet by the Tartarians two trumpetters of Braſſe, for a perpetuall memorie of their freedome gotten.

12.	175. 0'.	67. 0'.	North.

The Prouince Vng, which of our men is called Gogg.

13.	170. 30'.	65. 20'.	North.

The Realme of Tendus, which in the time of Marcus Paulus Venetus, (which was in the yeare 1290) was gouerned by thoſe Chriſtians, which deſcended from the King of Vncham.

The number of inſcrip.	Longitude.	Latitude.	North or South.
14	165. 30'.	65. 0'.	North.

The Caſtle of King Vacham was builded in this place, againſt the inuaſion of the Tartarians.

15.	157. 0'.	65. 30'.	North.

The Prouince Mongul, which of our men is called Magog.

16.	159 20'.	66. 0'.	North.

The deſart Belgian, which is very great, all ſandie and barraine.

17.	159. 0'.	61. 30'.	North.

In this Countrey of Cergutha, is found the beſt ſort of muske, which groweth like an impoſtume or bagge, nigh vnto the nauell of a certaine beaſt.

18.	165. 30'.	58. 0'.	North.

Campion is the Metropolitane towne of Ianguth, whereas the inhabitants are partly Chriſtians, partly Idolaters, and partly Mahometiſts.

19.	158. 0'.	53. 0'.	North.

This wall hath in length 400. Spaniſh leagues, and was built betwixt the mountaines by the King of China, againſt the inuaſions and excurſions of the Tartarians.

20.	176. 0'.	40. 0'.	North.

Iapan hath three Ilands much renowned, ſeparated one from another by a ſtraite of the Sea, whereof the firſt and greateſt is diuided into 53. Prouinces or Realmes, of which Meaco is the Metropolitane Citie, the ſecond called Xima, which hath 9. Prouinces or Realmes, the third is called Xicoca, which containeth but foure Prouinces or Realmes.

21.	71. 0'.	29. 0'.	North.

Medina Talnabi, is the Towne wherein is to be ſeene the Sepulchre of Mahoment.

The twelfth inſcriptions, belonging to Afrique.

The number of inſcrip.	Longitude.	Latitude.	North or South.
1.	67. 0'.	26. 0'.	North.

Coptos is a trimme Marchant towne, whereto are brought the Marchandizes of India, and of Arabia, in which towne are dwelling many Chriſtians.

2.	58. 0'.	51. 0'.	North.

The floud Nilus, which by his inundations doth yearely water and fatte the Countrey of Egypt, and maketh it maruellous fruitfull.

3.	55. 0'.	17. 0'.	North.

The floud Nubia, taketh his originall from the lake Nuba, as Ptolomie ſaith.

4.	50. 0'.	15. 0'.	North.

The floud Niger, heere taketh his courſe, running vnder the ground 50. leagues.

5.	62. 0'.	5. 0'.	North.

In this place is the ample iuriſdiction of the Emperour of Æthiopia, wrongfully called of thoſe of Europe, the land of Preſter Iohn: the Arabes and the Moores doe call him Aticlabaſſi, but his owne ſubiects doe call him Acegue, and Neguz, that is as much to ſay, as Emperour and King.

6.	58. 30.	2. 3'0	North.

The mount Amara, whereas are moſt carefully kept with continuall watch and ward of Souldiers, the children and Grand children of the Emperours of Æthiopia.

7.	53. 0'.	7. 0'.	South.

It is ſaid that this Countrie is inhabited of Amazones, which are women that make warre.

8.	55. 4'0.	15. 30'.	South.

In

The number of inſcrip.	Longitude.	Latitude.	North or South.

In this place the King of Monomotapa, hath his great and ample iuriſdictions.

9.	42. 3'0.	15. 40'.	South.

This South part of Afrique, vnknowne to the ancient writers, is called by thoſe of Perſia and of Arabia, Zanzibar.

10.	45. 3'0.	1. 0'.	South.

Here is digged out of the Mines, great abundance of gold.

11.	30. 20'.	20. 0'.	North.

Libia, or inward Afrique, is at this day called Sarra, or the deſerts.

12.	19. 0'.	15. 30'.	North.

The people Azanagi, are of colour black gray, and they couer their mouthes as a member of ſhame, and doe neuer vncouer them but when they eate.

The eleuenth Inſcriptions belonging to Mexicana.

1.	301. 3'0.	81. 0'.	North.

This Ile is thought to be the beſt and moſt wholeſome of all the North parts.

2.	310. 0'.	74. 0'.	North.

The Ile of Crockland, the Inhabitats whereof ſay that they had their originall from Swethland.

In the yeare of our Lord, 1500. one Gaſper Corteriale a Portugall, entered into theſe Regions, hoping to haue found ſome paſſage on the North towards the Iles Molucques, but arriuing at the Riuer, which by meanes of the abundance of Snow there falling, is called Rio Neuado, which hath in North Latitude 62. degrées, he did leaue to ſaile any further towards the North, by reaſon of the great cold there, and turning to the South, did fetch in all the Sea coaſts vntill he came to Capo Razo, which hath in North Latitude about 48. degrées: in the yeare 1504. The Brittans were the firſt that

diſcouered

The number of inſcrip.	Longitude.	Latitude.	North or South.

diſcouered all the ſea coaſts of new France in America, nigh vnto the Gulfe of S. Laurence, which hath in North Latitude about 50. degrées, and in the yeare 1524. Iohn Verazzona, and Florentine, did part from the Port of Diep, the 17. of March, in the behalfe of Francis King of France, and ſailed toward the South ſea coaſt of new France, whereas he arriued at the 34. degrée of North Latitude, and from thence ſailed towards the Eaſt, viewing all the ſea coaſts vntill he came to Cape Britaine, which hath in North Latitude about 46. degrées.

3.	311. 0'.	61. 30'.	North.

And in the yeare 1534. new France was againe viſited by the Admirall Iaques Cartier, and in the yeare next following, it was conquered to the vſe of the King of France: alſo in the yeare 1577. Martin Forboſher Engliſhman arriued at yͤ North ſtrait which is betwixt Groynland & Eſtotiland, yͤ place hauing by this Map in the North latitude 65. degr. ſéeking paſſage by the North vnto Cathay, whereas he found certaine Iles, & a mine of gold, wherwith hauing lodẽ his ſhips, he returned into England with great hope of profit, but his ſucceſſe was not anſwerable to his hope.

4.	275. 20'.	70. 0'.	North.

This dangerous beaſt is called Su caratha, which being chaſed of Hunters, doth take her young ones vpon her backe to ſaue both her ſelfe and them by flight.

5.	271. 0'.	64. 30'.	North.

This is a great lake or ſea of freſh water, the limits whereof are vnknowne, as they of Canada do ſay, and as they haue heard by relation of thoſe of Saguenay.

6.	293. 3'0.	52. 0'.	North.

Alongſt this Riuer a man may ſaile very commodiouſly, towards the countrey of Saguenay.

7.	287. 0'.	44. 40'.	North.

All thoſe that dwell betwixt Terra Florida, & Terra de Labrador be called by one common name Canadois, but there be many

The number of inſcrip.	Longitude.	Latitude.	North or South.
7.	287. 0'.	47. 4'0.	North.

diuers Nations, as thoſe of Hochelada, Honqueda, & Corterealis, they are all very courteous to ſtrangers, they liue cōmonly by fiſh, & they are clothed with ſkins of wild beaſts, as they be alſo that dwel further towards the North. This country is alſo called new France, becauſe the Britans which are Frenchmen firſt diſcouer it in the yeare of our Lord 1504. the conqueſt whereof was atchieued by the Admirall Iaques Cartier in the yeare of our Lord 1535. to the behoofe & vſe of the French King. In the mountaines towards the South, do dwell many and diuers Nations, which be cruell people, liuing without any law, and do ſéeke by continuall warres to vexe & oppreſſe one another, as the people Auanares, Albardi, Calicuares, Tagiles, Apalcheni, Mocoſe, Capaſchi, Chilage, & many others, amongſt which there be ſome of ſuch agilitie and ſwiftneſſe, as they may contend with horſes who can run faſteſt: they eat as thoſe of Florida, certaine kind of Spiders, Ants or Piſmires, Leazards, Adders and other venomous beaſts. The land of Baccalaos, is ſo called of the fiſh Baccalaos, which is there taken. Terra Florida is ſo called of Eaſter day, becauſe Iohn Ponce of Lion did diſcouer it on Eaſter day, in yͤ yeare 1512. the which day is called of the Spaniards Paſqua du Flores: this is a fertile country and rich in gold.

8.	271. 0'.	39. 0'.	North.

Marcus Nizza teſtifieth that this Prouince called the ſeuen Cities, is a very good countrey, with whom Francis Vasker doth not agrée, for he ſaith they be places of no value, and like to Villages, and be vnder the iuriſdiction of Ceuola, which at this preſent is called of the Spaniards Noua Granada.

9.	211. 4'0.	82. 0'.	North.

The North Ocean Sea, entring with 19. mouthes betwixt the Iles of the North, doth make foure ſtraits of the Sea, and running flouds, which continually take their courſe towards the North, and there are ſwallowed into the bowels of the earth, like to ſprings of fountaines and flouds.

The number of inſcrip.	Longitude.	Latitude.	North or South.

In mine opinion his Inſcription would haue béene one of the firſt of Mexicana, and not one of the laſt, ſith it is no ſmall leape, to turne ſo ſodainly from the middeſt of America to the North Pole.

10.	223. 0'.	55. 40'.	North.

This countrey is deſert and plaine, in which are many wild Horſes and Oxen, with high backs like Camels, and wild ſhéep like vnto thoſe which Boetius writeth (in his deſcription of Scotland) to be found in one of the Iles of the Hebrides.

11.	240. 20'.	40. 30'.	North.

New Spaine was brought by force of armes vnder the obedience of the Spaniard in the yeare 1518. by their Generall Ferdinando Cortes, who conquered the ſame with great loſſe of his Souldiers, but with greater ruine to the inhabitants, who fought for the libertie of their Countrey: the ſoyle is very fertill, and the Countrey is rich in gold and ſiluer, for in the flouds are found great ſands of gold, and in the mountaines is drawne out of the mines great quantitie of ſiluer, and alongſt the Sea ſide they take to their great profit an infinite number of Oyſters, wherein are found very faire Pearle. In this Prouince there are many ſalt lakes; the water whereof by force of the Sunne is turned into ſalt: there groweth alſo great aboundance of Caſſia fiſtula, and another kind of fruit, which the inhabitants cal in their tongue Cacaco, it is like to an Almond, they haue it in great price, for of it they make a certaine drinke, which they loue maruellous well. The ſea and flouds which doe waſh this Prouince, doe furniſh them with great plentie of fiſh, and in thoſe flouds are many Crocodiles, whoſe fleſh the inhabitants doe eate, and this beaſt will grow to be twentie foot long and aboue. This country is full of great mountains and high rocks, there is great diuerſitie of languages, in ſo much as one vnderſtandeth not another without an interpreter. Mexico is the Metropolitane and Royal towne, or rather the Quéene of all the principall townes in the world. It is ſituated vpon the ſide of a lake or mariſh, yea the very foundation of it is a very mariſh, in ſuch ſort as you can neither enter into it, nor come out of it, but by bridges, and it is as well peopled with inhabitants and Merchants, as any renowned Merchant Towne in Europe. The Towne is very great, for it containeth in circuit 3. Spaniſh leagues.

The number of inſcrip.	Longitude.	Latitude.	North or South.
11.	240.2'0.	40. 3'0.	South.

The ſixth Inſcriptions belonging to Peruana.

1.	333. '0.	3. 3'0.	South.

This great flood Maragnon, is called of ſome Oreigilana, and alſo the flood of the Amazones, it is diſcouered by Vincet Iohn Pinſonio, in the yeare 1499. and was ſailed in a manner from the head ſpring euen vnto the Sea, by Franciſco Oreigliano in the yeare 1542. the which voyage he performed in eight Moneths, hauing ſailed 1660. leagues. This riuer kéepeth his water ſtill freſh after it is entred certrine leagues into the Sea, by reaſon that his courſe is ſo ſwift and violent.

2.	330. 3'0.	22. 0'.	South.

Peruana is the South part of America, and is diuided by the Spaniards into fiue goodly Prouinces, that is to ſay, Caſtiliador, that is to ſay, the golden Caſtilia, Pompaiana, Peru, Chila, and Breſille: The Prouince Peru (before the arriual of the Spaniards) did extend a great deale further, when as their Countrie was yet vnder the Gouernment of their naturall King, which then was called Ingas, as Girana & others doe write. At this preſent it is limited on the North with the towne Quito, and towards the South with the Towne of Plata, that is to ſay, the ſiluer Towne, and it was called Peruana as ſome write, of the flood and Port of the Sea called Peru. It is at this preſent deuided (according to the ſituation of the Countrie) into thrée parts, that is to ſay, Sierras, Andes, and the flat or plaine Countrie.

The plaine Countrie is that which lieth alongſt néere to the Sea coaſt.

Sierra

The number of inſcrip.	Longitude.	Latitude.	North or South.
2.	330. 3'0.	22. 0'.	South.

Sierras is that part which is full of Mountaines.

And Andes is that part of the Mountaines which tendeth towards the Eaſt. Of all the Prouinces in the World, this is the richeſt in gold, and in Emeraldes. The Metropolitan Towne of this Prouince, is the Citie Lyma, otherwiſe called the Towne of Kings. Caſtillelledor tooke the name of the great abundance of gold that is there. The Prouince Propaiana tooke his name of the renowned Towne Propaian. Chila is a cold Countrie, by reaſon that it is nigh vnto the South Pole. The Prouince Braſilia tooke his name of the wood called Braſill, which groweth there in great abundance. To theſe Prouinces were meete to be ioyned theſe other Prouinces, that is to ſay, Caribana, Charchas, Chica, and the Land of the Patagones.

3.	329. 0'.	28. 0'.	South.

This beaſt is called of ſome Haute, but of a certaine people of Braſill, it is called Haye, which beaſt was neuer ſeene to eate or drinke, as ſome write, and therefore ſome thinke that ſhe liueth without meat or drinke, onely by the Ayre.

4.	328. 0'.	35. 20'.	South.

This kind of beaſt is found in the Prouince of Paras, which in her fore-parts is like a Fox, and behind ſhe is like an Ape, ſauing that ſhe is footed like a man, and ſhe hath the eares of an Owle, and vnder her ordinarie belly, ſhe hath alſo another belly, which openeth and ſhutteth, wherein ſhee lodgeth her yong ones, vntill they are able to get their owne liuing, and ſhe neuer ſuffereth them to goe out, but only to ſucke. Geſner calleth this Beaſt an Ape-Foxe, or a Foxe-Ape.

5.	329. 3'0.	36. 3'0.	South.

This is the Land of the Patagones, the inhabitants whereof are Giants nine or ten foot high, which doe paint their viſages with diuers colours, made of herbes.

In

The number of inſcrip.	Longitude.	Latitude.	North or South.
6	335. 0'	51. 3'0	South.

In the yeare 1582. the King of Spaine commanded here to be built certaine Fortreſſes, at the entry or mouth of the ſtraight, called Mare Magellanicum.

The twentie one inſcriptions belonging to Magellanica.

11	188. 3'0	17. 20'.	South.

This Land is new Guinea, ſo called of the Nauigants and pilots, becauſe the Sea Coaſt and ſituation thereof is like to that of Guinea in Afrique, and it was called by Andrew Corſali a Florentine, the Land of Piccinacoli, and perhaps it is that which Ptolomie calleth the Ile Labadia, if it may bee called an Ile, for it is not yet knowne whether it bee any part of the South firme Land or no.

2.	209. 0'	31. 3'0.	South.

It is not vnknowne to all thoſe that are exerciſed in Geographie, that the degrees of Longitude doe diminiſh and decreaſe from the Equinoctiall to either of the Poles either North or South, whereby it falleth out, that the Prouinces which are next vnto the two Poles of the World, doe differ greatly from the naturall ſhape which they haue by the roundnes of the earth, and for that cauſe wee haue briefly drawne a deſcription of the whole world in 2. round figures or circles at yͤ end of the Map, to the intent that euery man might ſee their naturall ſituation ſo farre as may be ſhewed in Plano, that is to ſay, in flat forme.

3.	231.	72.	North.

Theſe Prouinces at this preſent are little knowne, yet it is ſayd, that they are full of many kinds of wild Beaſts. You ſhall find this inſcription in the round figure on the left hand nigh to the North Pole, which indeed belongeth to Mexicana, and not to Magellanica.

4	247. 2'0.	14. 0'.	South.

Theſe two infortunate Ilands were ſo called by Magellane himſelfe, becauſe he could find in thẽ neither men, nor any thing

elſe

The number of inſcrip.	Longitude,	Latitude	North or South.
4.	247. 20'	14. 0.	South.

elſe that was meete for mans ſuſtenance.

5.	283. 0'.	61. 2'0	South.

These Prouinces were diſcouered by a Spaniard, who being ſeparated by tempeſt at Sea from the Fleet or Armie, ran wandring here and there through this great Southerne Sea.

6.	350. 4'0.	85. 2'0.	South.

In the yeere 1493. when as they deſire to ſayle into far Countries, increaſed more and more amongſt the Caſtilians, and Portugals, and that with great contention who ſhould diſcouer moſt, Pope Alexander ordayned, that the Meridian which is 100 leagues diſtant towards the Weſt, from euery on of the Ilands as well of Capo verde, as of thoſe which they call Azores, ſhould be the bounds and limits to either partie for their Nauigation, determining their rights in ſuch ſort, as the Caſtilians ſhould haue the Weſt part of the World to find out vnknowne Countries, and the Portugals the Eaſt part, but there was ſuch ſtrife and contention betwixt them afterward touching the bounds of Nauigation, as this Ordinance of Pope Alexander pleaſed neyther party, and therefore in the yeere 1524. it was fully determined that the Meridian which is diſtant 370. leagues towards the Weſt from the Ile S. Anthonio, being the moſt Weſterne Ile of all the Iles of Capo verde, ſhould be the common bound of Nauigation to both parties.

7.	19. 0'	54. 3'0.	South.

Heere vnder the latitude 42. degrees, and diſtant 450. leagues from the Cape de bona Speranza, and alſo 600. leagues diſtant from the Cape S. Auguſtine, was found the Promontorie of the Southland, as Martin Ferdinando Dencilo hath noted in the Epitome or ſumme of his Geographie.

8.	22. 0'.	65. 0'	South.

In this our Geographie, wee haue in ſuch manner deſcribed the circuit of the whole Earth, as all the Countries are ſitua-

ted

The number of inſcrip.	Longitude.	Latitude.	North or South.
8.	22. 0.	65. 0'.	South.

ted vnder their proper Meridians, which could not haue beene done without extending them more or leſſe from the Weſt towards the Eaſt, notwithſtanding being deſirous to ſatiſfie thoſe that are practiſed in the Art of Nauigation, we haue deſcribed the North Prouinces of Europe in this our Geographie, in ſuch ſort as their ſituation wholy agreeth with the particular Mariners Cards.

9	57. 2'0.	54. 0'.	South.

The nine Inſcription intituled to the louers of Geographie.

We haue in this inſcription of the whole Earth employed all diligence to deſcribe all the Seas and Prouinces, in ſuch ſort as euery place may haue his true longitude and latitude, in which matter we haue ſpared neither labor nor coſt, for we haue diligently conferred together the Sea Cards, as well of the Caſtilians as Portingales, which they vſe in their nauigations to America, & to India: and amongſt others we obtained from Portingal a Mariners Card, deſcribing the whole Earth very correctly, and beſides that fourteene other particular Cards, in the which likewiſe all the Seas and Prouinces of the whole world with their ſituation were compriſed: all which Cardes, being compared together, we here now ſet forth this new deſcription of all the Prouinces and Seas in the whole World, and that as correctly as may be, according to the conſideration & obſeruation which hath beene vſed by the moſt expert Geographers and Pilots, euen vnto this preſent houre: for in this Card wee doe deſcribe all the Sea Coaſts, Promontories, windings in and out, Iles, Ports, Depths, Sands, Sholds and Rocke, alſo we haue added thereunto in place conuenient, the Mariners Compaſſe, and the lines of the Winds, which we haue ſet downe as correctly as was poſſible for vs to doe, for the commodity of nauigation: and for ſo much as the true Longitude of the places cannot wel be obſerued, without extending or enlarging too far thoſe Prouinces that are nigh vnto yͤ North or South Pole of

the

The namber of inſcrip.	Longitude.	Latitude.	North or South.
9.	57.	2'0. 54.	0' South.

the World, we haue therefore briefly comprehended the ſame in this our diſcription of the world, in two rundles or circles, vnto the which we haue added another little Geographicall Card, comprehending the North prouinces of Europe, to intent that in them euery man may ſee with his eies yͤ naturall ſituation of thoſe Prouinces as wel as it may be done in Plano, as is more amplie declared in other inſcriptions of this map. And this little Septentrionall Map laſt mentioned, is placed at the foot of this Map, in the very middeſt thereof comprehending all the North parts that lie betwixt the 52. degrees, and 72. of Latitude.

10.	79. 3'0.	56. 0'.	South.

Here is a very ſtrong current of the Sea, which runneth Eaſt and Weſt betwixt Madagaſcar and the Ile Romeros, in ſuch ſort as nauigation there is very troubleſome and laborious, as Marcus Paulus Venetus teſtifieth in his third Booke & 40. Chapter: whereof it muſt needs follow of neceſſitie, that the Sea-Coaſts of this Countrie are not farre diſtant from Madagaſcar, in ſuch ſort as the great Orientall Sea doth ebbe and flow through this ſtraight with great violence into the Weſt Ocean Sea, whereunto agreeth yͤ letter miſſiue of a Candiot, who was Embaſſadour for the Venetians to the King of Porugall. In which letter hee writeth that the men of this Countrie goe all naked.

11.	91. 0'.	35. 0'.	South.

To this place arriueth a Portugall ſhip called S.Paul.

12.	212.	36.	South.

The South firme Land is called of ſome Magellanica, of Ferdinando Magellanus, who firſt diſcouered the ſame.

This inſcription, together with the foure next following, are to be found in the rundle on the right hand.

13.	146.	46.	South.

Marcus Paulus Venetus, and Lewes Vertiman doe teſtifie in their Bookes of peregrination, that here be very great and ample Deſerts.

Be-

The number of inſcrip.	Longitude.	Latitude	North or South.
14.	75. •	25.	North.

Betwixt the Ile of S. Laurence and the Iles Romeros, do fall a moſt violent flux and reflux of the Sea, Eaſt and Weſt.

15.	46	55	South.

This is the Land of Popeniayes, ſo called of the Portugals becauſe thoſe Birds in that Country are of incredible bigneſſe.

16.	15	46	South.

This Promontorie of the South Land is ſituate 450. Spaniſh Leagues from the Cape de bona ſperanza, and 600. leagues from the Cape of S. Auguſtine.

17.	148. 0'.	34. 0'.	South.

As we haue in the firſt rundle on the left hand ſet downe the deſcription of that part of the World, which extendeth from the Equinoctial to the North Pole: ſo in this other rundle we haue ſet downe a deſcription of that part of the World, which extendeth from the Equinoctiall to yͤ South Pole, in ſuch ſort as this rundle containeth all Magellanica, and almoſt all Peruana, together with a great part of Afrique, and a great number of the moſt Noble and Renowned Iles in the World, and herein you may plainly ſee with your eye the naturall ſituation of thoſe Prouinces that are nigh vnto the South Pole.

18.	148 30'	20. 30'	South.

The Realme of Maletur, ẇ aboundeth in all manner of ſpices.

19.	148. 0'	15. 4'0.	South.

The Country of Breach in gold, but little frequented by Marchants of other Countries, by reaſon of the crueltie of the people.

20.	161. 0'.	20. 0'	South.

Iaua minor, bringeth forth diuers ſpices which haue not yet beene ſeene in Europe, as Marcus Paulus Venetus teſtifieth in his third Booke 13. Chapter.

21.	170. 4'0.	2. 0'.	North.

The

The Iles Moluccas are much renowned for the great abundance of Spices, which are ſent from thence into all Countries of the World: The chiefeſt of thoſe Iles are theſe, Ternarie, Tidoris, Motir, Machian, and Bachian, vnto which ſome doe adde Gilolo, Celebes, Burro, Amboino, and Bandar.

Beſides all theſe Inſcriptions Plancius at the 4. corners of his Map ſetteth downe 4. Rundles, two aboue, and other two beneath: and in that aboue on the left hand, repreſenting the Northerne halfe of the Celeſtiall Globe, hee deſcribeth all the North ſtars that are alreadie, and in the other Rundle on the right hand, repreſenting the Southerne halfe of the Celeſtiall Globe, he doth not onely ſet downe ſuch Southerne ſtarres as were knowne to the ancient Aſtronomers, but alſo ſuch Southerne ſtarres as haue béene found out of latter dayes, by thoſe that haue trauailed into the Eaſt and Weſt Indies, as the Croſſe, the Southerne Triangle, Noes Doue or Pigeon, and another in the ſhape of a man called Polophilax, and certaine others, touching which ſtarres hee ſetteth downe nigh vnto the foreſaid rundle, a certaine inſcription written in the Latine tongue, which I haue here interpreted word for word in our mother tongue as followeth.

We haue here ſet downe the fixed ſtarres in their true places anſwerable to the yeare 1592. and not 95. as the Printer hath made it.

Of the South Pole and of the Starres that are about the ſame.

LEaſt the South part of this Hemiſphere or halfe Globe, ſhould remayne void and empty, I haue taken theſe Southerne Starres of the obſeruation of Andreas Corſalius Florentine, and haue diligently compared the ſame with the writings of Americus Veſpucius, and of Petrus Medina, and haue reduced the ſayd Starres into this forme or ſhape. But for ſo much as I haue ſeen nothing as yet to my ſatiſfaction or contentment touching the Longitude, Latitude, Magnitude or nature of the ſaid ſtars, I hartily pray al thoſe that haue any more certain knowledge of this matter then we, that they wil informe vs thereof to the common good of all men: As touching the Pole Antarctique Corſalius writeth, that there bée two cloudie ſtarres of a meane bigneſſe, which with a Circular motion doe goe about another ſtarre, that is diſtant from the Pole almoſt 11. degrées, and are ſometime aboue and ſometime beneath the ſaid ſtarre: Hitherto Plancius. But now to the intent that you may the better vnderſtand all the foreſaid rondles, I thinke it not amiſſe to deſcribe the ſame vnto you, and to ſhew the vſe thereof as followeth. You haue to note then, that the two vpper rondles, that which is on the left hand, ſignifieth the Northerne halfe of the Celeſtiall Globe, and the other rondle on the right hand, ſignifieth the Southerne halfe of the ſaid Globe as hath béene ſaid before, and each one of theſe rondles is traced with certaine Circles and Lines: The outermoſt Circle thereof being diuided into 360. degrées, and containing the Characters of the 12. Signes, ſignifieth the Zodiaque, or rather the very Ecliptique it ſelfe, the Centre of which Circle is the Pole of the Zodiaque, which by continuall turning about deſcribeth another leſſer Circle hard by it, ſignifying in the North rondle the Circle Arctique, and in the South rondle the Circle Antarctique, the Center of which leſſer Circle in either rondle is the Pole of the World, both which Poles are diſtant from the Pole of the Zodiaque 23. degrees 28. which is the greateſt declination of the Sun. Moreouer in either rondle are drawne vpon each Pole of the world two other Circles, the largeſt whereof ſignifieth in both rondles the Equinoctiall, and the leſſer thereof in the North rondle, ſignifieth the Tropique of Cancer, and in the South rondle the Tropique of Capricorne: beſides theſe Circles each rondle is traced with 12. right lines, ſignifying thoſe ſixe Meridians or Lines, which paſſing through both the Poles of the Zodiaque doe deuide the Zodiaque into 12. equall parts, euery part containing 30. degrées: for ſo many degrées doe belong to the Longitude of euery one of the 12. Signes, whereby the Zodiaque hath in Longitude 360. degrées, which Longitude is to be counted from the firſt point of Aries and ſo forth, according to the ſucceſſion of the Signes: and by helpe of theſe lines, you may know vnder what Signe any fixed ſtar is: I ſhall not néed here to ſhew you how the ſayd fixed ſtars are ſituated in either of the rondles, nor how they are named, becauſe their Images or ſhapes together with their names are apparant for your eye. But if you would know the true place, the Longitude, Latitude, Magnitude, and the nature of any fixed ſtar herein contained, then doe thus: firſt to know the place and Longitude of any ſtarre, lay a Ruler, or extend a Thréed, ſo as it may paſſe through the Pole of the Zodiaque, and alſo through the body of the ſtarre, whoſe place and Longitude you ſéeke, euen to the very Zodiaque, & ſomewhat beyond, and thereby you ſhall know in what Signe, and in what degrée thereof that ſtar is, for that is his place, and you ſhall know his Longitude, by counting from the firſt point of Aries vnto that degrée, for that is his Longitude.

Now to know the Latitude of any ſtar, you haue to note that in each rondle, there is a certaine right blacke line extending from the Zodiaque to the Pole, diuided by vnequall ſpaces into 90. degrées, which line is called the ſcale of the fixed ſtars Latitude, the vſe whereof is thus: Set the firme foot of your Compaſſes in the very Pole, and extend the other foote into the middeſt of the body of that ſtar, whoſe Latitude you ſéeke, and turne that foote ſtanding at that wideneſſe to the ſcale, and the number of degrées written vpon the ſcale, if you count from the Zodiaque vpward towards the Pole, will ſhew you the Latitude of that ſtarre. Againe, to know the magnitude of any ſtar, Plancius ſetteth downe in the North Rondle the ſelfe ſame meane, which Mercator alſo vſeth in his Celeſtiall Globe, that is to ſay, by making certaine ſhapes of ſtarres repreſenting the bigneſſe of euery ſtar, according to his greatneſſe, that by marking and comparing thoſe ſhapes together, you might finde out, or rather coniecture the greatneſſe of the ſtarre which you ſéeke. Laſtly he ſheweth the nature of any ſtar, by ſetting downe nigh vnto the ſtar the Characters of thoſe Planets, of whoſe nature that ſtar

doth

doth participate, all which things you ſhall more plainly vnderſtand by this example here following.

Suppoſe that you would know the place, longitude, latitude, magnitude, and nature of the ſtar called Arcturus: here becauſe this is a North ſtar, you muſt therfore reſort to ẏ North rondle, and there ſéeke out the Image Bootes, betwixt whoſe legs is the ſtar called Arcturus which you ſéeke. And by extending a thréed which may paſſe through the Pole, and alſo through the body of that ſtar, euen to the Zodiaque, and ſomewhat beyond, you ſhall finde his place to be in the 19. degrée of the ſigne Libra, and his longitude counting from the firſt point of Aries vnto that degrée, to be 199. degrées, and by obſeruing the rule before giuen, touching the knowing of the latitude of any ſtar, you ſhal with your Compaſſe find the Latitude of this ſtar to be almoſt 32. degrées Northward, and by his ſhape you ſhall know that hée is of the firſt magnitude, and the Characters of the two Planets Mars and Iupiter, placed hard by him, doe ſhew that he is of their nature, that is to ſay, by participating of Mars he is extremely hot and drie, and by participating of Iupiter he is hot and moiſt, and loke what order is to be obſerued in the North rondle, touching the North ſtarres, the ſame is likewiſe to bée vſed in the South rondle containing the Southerne ſtarres: Amongſt which you may ſée the Image called the Croſſe, whereby moſt Pylots in theſe dayes do chiefly direct their courſe, being once paſt the Equinoctiall towards the South pole, which Croſſe though Plancius doth here make to conſiſt of fiue ſtarres, yet I am ſure that Martin Cortes and Peter Medina, and all other late Writers doe appoint thereunto but foure ſtarres, the ſhape and vſe whereof I haue ſet downe in my Treatiſe of Nauigation, according to the direction of Peter Medina. And thoſe that haue trauelled into the Indies, doe all affirme that to the Croſſe there doe belong onely foure ſtarres and no more, wherefore I maruaile much that Plancius doth ſet downe fiue, whereunto perhaps he is induced by the relation of ſome Spaniard that did miſtake them. Thus hauing deſcribed vnto you the two vpper rondles, repreſenting together ẏ celeſtial Globe, and alſo ſhewed the vſe thereof, I will now deſcribe the two nether rondles, whereof that on

the

the left hand repreſenteth the North halfe of the Terreſtriall Globe, and that on the right hand the other halfe of the ſame Globe, towards the South.

You haue then to vnderſtand that the Centre or middle point in each rondle, ſignifieth the Pole of the World, that is to ſay, the North Pole in the North rondle, and the South Pole in the South rondle, and vpon each Pole are drawne certaine Circles, the vttermoſt whereof, and furtheſt diſtant from the Pole, ſignifieth the Equinoctiall, which is diuided into 360. degrees, euery degree containing 60. miles, which is the whole Longitude of the Earth, from which Circle at the end of euery tenth degree, are drawne certaine right lines to the number of 18. which doe meete in the very Pole, and doe ſignifie halfe Meridians, whereof that which paſſeth through the Iles Azores, and alſo the Iles of Capo Verde, is the firſt Meridian, from whence the Longitude of the Earth taketh his beginning, and there alſo endeth: which Meridian in the rondle on the left hand, is deuided into 90. parts, proceeding from the Equinoctial to the Pole, ſignifying the North Latitude of the World: the like diuiſion and number of degrees of Latitude, hath alſo the firſt Meridian, in the rondle on the right hand, ſauing that the ſaid Meridian tendeth vpward. Moreouer you haue to vnderſtand, that in each of theſe rondles are drawne nine Circles, equally diſtant one from another, called Parallels, which together with the Equinoctiall, doe make nine ſpaces, euery ſpace containing 10. degrees, and beſides theſe Circles, there are drawne in each rondle two other Circles, the one greater and the other leſſer. The greater in the rondle on the left hand being diſtant from the Equinoctiall, 23. degrees 3'0. which is the greateſt declination of the Sunne, is called the Tropique of Cancer, and the leſſer Circle being of like diſtance from the Pole, is called the Circle Arctique, but the greater Circle being of like diſtance from the Equinoctiall, in the rondle on the right hand, is called the Tropique of Capricorne, and the leſſer Circle in the ſaid rondle inuironing the Pole, is called the Circle Antarctique, vpon which Circles in each rondle you ſhall find their names written. The chiefeſt vſes of theſe two rondles are theſe: firſt to finde out the

Longitude of any place, ſecondly the Latitude, and thirdly the diſtance betwixt any two places.

To find out the Longitude of any place, you muſt doe thus: Extend a thred, ſo as it may paſſe through the Pole, and alſo through the place whoſe longitude you ſeeke, euen to ỹ very Equinoctiall, and ſomewhat beyond, & holding the thred ſtraight, the numbers of the degrees written vpon the Equinoctiall will ſhew the longitude of the place.

And if you will know the latitude of that place, or of any other, doe thus, ſet the one foot of your Compaſſe in the very Pole, extending the other to the place whoſe Latitude you ſeeke and keeping your Compaſſe at that widenes, bring the moueable foot to the firſt Meridian, whereon the degrees of Latitude are marked, and there ſtaying it, the number of the degrees, counting from the Equinoctiall vpward towards the Pole, wil ſhew the Latitude of the place: As for example, ſuppoſe that you would know the longitude and latitude of Lisbone which is a famous Towne in Portugall, here hauing firſt found out that Towne in Spaine, which is nigh vnto the Weſt Ocean, extend your thred from the Pole through the middeſt of that Towne to the Equinoctiall and ſomewhat beyond, and you ſhall find that the thred will cut the Equinoctiall in the 13. degree, which is the Longitude of Lisbone. Now if you would know the latitude of the ſame place, ſet the one foote of your Compaſſe in the Pole, and extend the other foote to Lisbone, and keeping your Compaſſe at that wideneſſe, bring the moueable foote to the ſcale of latitude, and ſo you ſhall find that Lisbone hath in North latitude 38. degrees and 3'0. Now to know the diſtance betwixt any two places, doe thus, Set the one foote of your Compaſſe in the one place, and the other foot in the other place, and apply that wideneſſe to the Equinoctiall, and look how many degrees of the Equinoctiall that wideneſſe cōprehendeth, and by allowing 60. Italian miles to euery degree, you ſhall haue the diſtance by a right line betwixt thoſe two places, for by doing thus, you ſhall find the diſtance betwixt Lisbone and Compoſtella, to bee 120. miles. Thus I haue ſufficiently (I hope) expounded euery thing contained in Plancius his Mappe, his generall ſcale made for the ſame onely excepted, whereof I come now to ſpeake. In this ſcale are ſet downe the miles of Ruſſia, of Italie, of England, of Scotland, the French leagues, the houre leagues for Mariners, the Spaniſh leagues, the German and Garſcaine miles, which two are all one, the miles of Sweuia in Germanie, of Scandia & of Swethland, which laſt three are likewiſe all one, the vſe of which ſcale is thus: Take with your Compaſſe the diſtance betwixt any 2. places which you deſire to know, and apply the ſame to the ſcale of ſuch miles as you would know, and ſo many miles the 2. places ſhall be diſtant one from another as the number of the ſcale doth ſhew: but if the diſtance betwixt the 2. places be longer then the ſcale, then hauing firſt taken the whole length of the ſcale with your Compaſſes, looke how many times that wideneſſe of your Compaſſe (meaſuring by a right line) is contained in the diſtance betwixt the two places, and if there be any odde ſpace left, ſtretch then your Compaſſe to that odde ſpace, and apply that to the beginning of the ſcale, and adde the number of miles which you there find to the firſt great number, ſo ſhal you haue the total ſumme. And loe heere for each an example. Firſt ſuppoſe that you would know the diſtance betwixt Cape S. Marie, and Cape finis terre, which are two Capes or head lands in the Weſt ſide of Spaine, both hauing in a manner one ſelfe Longitude, and doe differ only in latitude by 6. degrees, for the one hath 37. and the other 43. in Latitude, which diſtance if you take with your Compaſſe by ſetting the one foot in the one place, and the other foot in the other place, and applying that wideneſſe to the ſcale of Italian miles, you ſhall find the diſtance to be 390. Italian miles, but if you meaſure the ſame diſtance according to the Geographicall manner, which is to allow for euery degree of Latitude 60. miles, you ſhall find the diſtance to bee no more but 360. Italian miles. Let your other example be thus: Suppoſe that you would know the diſtance betwixt Compoſtella in Spaine and Conſtantinople, which haue all one Latitude and doe differ onely in longitude, here becauſe the diſtance betwixt theſe two places is longer then the ſcale, you muſt take with your Compaſſes the whole length of the ſcale, and then to looke how

how many times that wideneſſe is comprehended (meaſuring by a right line) betwixt the two ſaid places, and you ſhall find that wideneſſe to be comprehended in the diſtant betwixt thoſe two places three times, wherefore if you multiply 840. by 3. it will make in all 2520. Italian miles. But if (according to the Geographicall kind of meaſuring) you doe multiply the difference of their Longitudes, which is 43. degrees, by the number of miles, which is alſo 43. belonging to the Latitude of both places, which Latitude is alſo very nigh 43. degrees, you ſhall find that the diſtance betwixt thoſe two Townes is no more but 1870. Italian miles, which number of miles is not ſo great as that of the ſcale by 650. Italian miles. And therefore I cannot thinke but that there is ſome errour in the ſcale, committed either by the Printer or elſe by the Authour, through ſome negligence, and not for lacke of ſkill or knowledge how to make a true ſcale, being ſo excellent a Geographer, as the Author by this and other his Maps heretofore made, ſheweth himſelfe to be, or elſe there is ſome greater miſterie therein, then I perhaps do vnderſtand, for in ſeeking to know the diſtance betwixt two places differing onely in Latitude, I find the ſcale moſt times to agree with the Geographicall kind of meaſuring, but if the two places doe differ either in Longitude onely, or elſe both in Longitude and alſo in Latitude, then I find the ſcale to differ very much from the Geographicall kind of meaſuring. Wherefore I thinke it good briefly heere to ſet downe certaine ready waies of finding out the diſtance of two places, differing either in Latitude onely, in Longitude onely, or in both, which I do ſhew alſo at large in the ſecond part of my Spheare, Chapter 14.

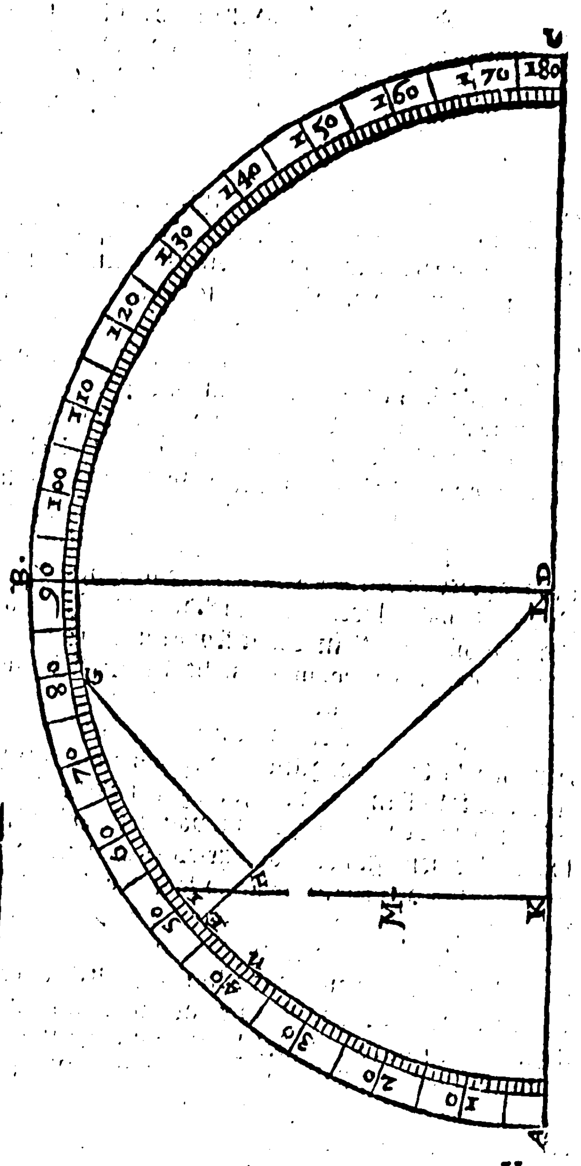
How to find out the diſtance of two places differing only in Latitude.

IF the two places haue both either North or South latitude, then ſubtract the leſſer latitude out of the greater, ſo ſhall you haue the difference, which difference if you multiply by ſixty, the product ſhalbe the number of miles, and if to the whole degrées of difference there be annexed any minutes, then you muſt adde to the product for euery minute one mile. But if one of the two places haue North Latitude, and the other South Latitude, then you ſhal find their difference by addition, and not by ſubtraction. As for example, ſuppoſe that you would know the diſtance betwixt a Towne called Paſquali, which is the outermoſt Towne in Morea vpon the Sea towards the South, hauing in North Latitude 35. degrées 3′0. and a certaine Towne in Afrique called Debſan ſtanding nigh vnto the lake Zembre, which hath in South latitude 12. degrées 3′0. heere by adding theſe two latitudes together, you ſhall find the ſumme to be 48. degrées, and that is the difference of their Latitudes, which difference if you multiply by 60. the product will be 2880. and that is their diſtance.

How to find out the diſtance of two places differing onely in Longitude.

IF both places haue either Eaſt Longitude or Weſt Longitude then ſubtract the leſſer out of the greater, ſo ſhall you haue the difference, which difference you muſt multiply by the number of miles belonging to their Latitude, which you ſhall finde on the North Weſt ſide of the Mappe, or by the Table of miles, anſwerable to one degrée of euery Latitude, ſet downe heereafter in the end of this Treatiſe: and the product thereof ſhall bée the number of miles whereby the one place is

diſtant from the other. As for example, I find Compoſtella in Spaine, and Conſtantinople, hauing both almoſt 43. degrées of North Latitude, to differ only in Eaſt Longitude, for Compoſtella hath in Eaſt Longitude 13. degrées, 3′0. and Conſtantinople hath in Eaſt Longitude 56. degrées, the difference whereof by ſubtracting the leſſer out of the greater, you ſhall find to be 42. degrées 3′0. héere if you multiply 42. by 43. miles belonging to one degrée of the foreſaid Latitude 43. you ſhall find the product to be 1806. then to find out the value of miles for the fraction 3′0. by the rule of proportion, you muſt ſay thus: if 60. require 43. miles, what ſhall 30. require, and you ſhall find in the quotient 21. miles, which you muſt adde to the former ſumme 1806. and it will make in all 1827. miles and $\frac{1}{2}$ which is the true diſtance betwixt the two foreſaid places. But if the one place haue Eaſt Longitude, and yͤ other Weſt Longitude, then you muſt find the difference as well by addition as by ſubtraction. As for example, ſuppoſe that you would know the diſtance betwixt S.Domingo in the Ile called Hiſpaniola, and a certaine place in Afrique called Septem montes, nigh vnto the Ocean ſea, both places hauing 18. degrées of North Latitude: And S.Domingo hath in Weſt Longitude 310. degrées 3′0. and the place called Septem montes, hath in Eaſt Longitude 7. degrées. Héere you muſt firſt ſubtract 310. degrées 3′0. out of 360. degrées, and there will remaine 49. degrées 3′0. whereunto you muſt adde the Eaſt Longitude of Septem montes, which is 7. degrées, and it will make in all 56. degrées 3′0. which is the difference of their Longitude. Now if you firſt multiply 56. degrées by 57. miles belonging to 18. degrées of Latitude, you ſhall find the product to be 3192. miles, and to find out the value of miles for the fraction 3′0. you muſt ſay thus: If 60. require 57. miles, what ſhall 3′0. require, and working by the common rule of 3. you ſhall haue in the quotient 28. miles, and there remaineth $\frac{1}{2}$, which is one halfe mile. Now by adding 28. miles & $\frac{1}{2}$ to 3192. it wil make in all 3220. miles $\frac{1}{2}$ and that is the true diſtance betwixt S.Domingo & Septem montes, but by Plancius ſcale you ſhall find the diſtance to be 3410. miles, which differeth from the other almoſt 200. miles.



	Longitude.	Latitude.	
	degrees.	degrees.	
London:	22. 0'.	51. 32'.	The greater Latit.
Hieruſalem:	69. 0'.	32. 0.	The leſſer Latit.
The difference of their Longitudes,	47. 0.		

How

How to find out the diſtance of two places differing both in Longitude and Latitude, by helpe of a Semicircle diuided into 180. degrees, which I had from my louing friend Maſter Wright *of* Caius *Colledge in* Cambridge, *of whom I make mention as well in my Treatiſe of the Spheare as in that of Nauigation.*

FIrſt draw a Semicircle vpon a right Diameter, marked with the letters A. B. C. D. whereof let D. bee the Centre like vnto this heere deſcribed, and the greater that ſuch Semi-circle is, the ſpaces of the degrees ſhall bee the larger, and thereby the more eaſie to finde out the minutes. Then hauing drawne your Semi-circle, and diuided the ſame accordingly, ſuppoſe that by helpe thereof you would find out the diſtance betwixt London and Hieruſalem, which two Townes do differ both in Longitude, and alſo in Latitude ſo much as is heere ſet downe in the front of the figure, according to ſuch Longitude and Latitude as Plancius doth allow to either Towne in his great Map. Now to finde out the true diſtance of theſe two Townes, you muſt firſt take the leſſer Longitude out of the greater, ſo ſhall you haue the difference of their Longitudes, which is 47. degrees, then count that difference vpon the Semicircle, beginning at A. and ſo proceed to B. and at the end of that difference, make a pricke marked with the Letter E. vnto which pricke draw a right line by your ruler from D. the Center of the Semi-circle: That done, ſeeke out the leſſer Latitude which is 32. degrees 0'. in the foreſayd Semicircle, beginning to account the ſame from the pricke E. and ſo proceed towards the letter B. and at the end of the ſaid leſſer Latitude ſet downe another pricke marked with the letter G. from which pricke or point draw a perpendicular line, which by helpe of your ſquire or compaſſes, may fall with right Angles vpon yͤ former right line drawne from D. to E. and where it falleth, there ſet downe a prick marked with the letter H. that done, ſeeke

out

out the greater latitude which is 51.degrées and 3'2.in the foreſayd Semicircle, beginning to accompt the ſame from A. towards B. and at the end of that Latitude ſet downe another pricke, marked with the Letter I. from whence draw another perpendicular line that may fal by helpe of your ſquire or compaſſes, with right Angles vpon the Diameter A. C. and there make a pricke marked with the letter K. That done, take with your Compaſſe the diſtance that is betwixt K. and H. which diſtance you muſt ſet downe vpon the ſaid Diameter A.C.ſetting the one foote of your Compaſſe vpon K. and the other towards the Centre D.and there make a prick marked with the letter L then take with your compaſſe the length of the ſhorter perpendicular line G. H. & apply that wideneſſe vpon the longer perpendicular line I. K. ſetting the one foot of your Compaſſe at I. which is the end of the greater latitude, and extend the other foot towards K,and there make a pricke marked with the Letter M. That done,take the diſtance betwixt L. and M. with your Compaſſe, and apply the ſame to the Semicircle, ſetting the one foote of your Compaſſe in A, and the other towards B. & there make a prick marked with the letter N. And the number of degrées contayned betwixt A. and N. will ſhew the true diſtance of the two places, which you ſhal find to be 39.degrées, which being multiplyed by 60.maketh in all 2340. myles, and whenſoeuer you haue any minutes beſides the whole degrées, remember to adde vnto the ſumme of degrées,for euery minute one myle. By Plancius ſkale you ſhall find the diſtance betwixt London and Hieruſalem to be 3040.miles which are 700.miles too many. But you haue to note by the way, that if the difference of the Longitudes doth excéed the number of 180. then you muſt ſubtract that excéeding difference out of 360. and the remaynder ſhall be the difference of the Longitudes, and then worke in all points as is before taught.

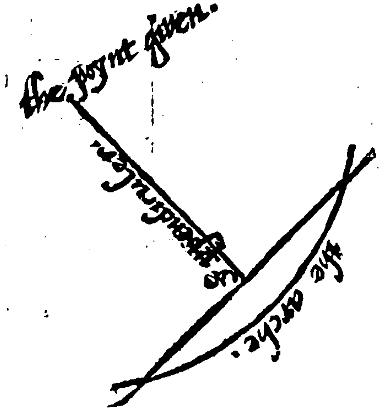
By this rule and the other two rules firſt declared, you ſhall eaſily try the Skale of any Map whether it bee true or not, ſo as you firſt haue the true Longitude and Latitude of the two places whoſe diſtance you ſéeke to know. And thus I end with Plancius Map, hoping not to offend him with any thing that I

haue added thereunto for the better inſtruction of thoſe that haue not béene exerciſed in ſuch matters.

And yet I had almoſt forgotten one thing, which is this, I haue héere before as you haue read, made mention of drawing certaine perpendicular lines in the former figure of the Semicircle, by helpe of your Compaſſes. Wherefore I thinke it neceſſarie héere to ſet downe the order thereof.

How to make with your Compaſſes a perpendicular line to fall from any point giuen vpon another right line, making therewith right Angles without the helpe of any ſquire.

SEt the firme foote of your Compaſſe in the point giuen, and extend the other foote a little beyond the line right againſt the point giuen, and draw a ſecret Arch or portion of a Circle, that may cut the ſaid line in two points, and diuide that part of the Arch which lieth betwixt the two ſections into two equall parts, ſetting a pricke in the very midſt thereof: then hauing laid your rule to that pricke, and alſo to the point giuen, draw a right line, and that line will fall vpon the other line with right Angles, as you may ſée by this figure.



The Table of miles anſwerable to one degree of euery ſeuerall Latitude.

D.	M.	S.	D.	M	S.	D.	M	S.	D.	M	S.	D.	M	S.
1	59	59	19	56	44	37	47	55	55	34	25	73	17	33
2	59	58	20	56	23	38	47	17	56	33	33	74	16	32
3	59	55	21	56	1	39	46	38	57	32	41	75	15	32
4	59	51	22	55	38	40	45	58	38	31	48	76	14	31
5	59	46	23	55	14	41	45	17	59	30	54	77	13	30
6	59	40	24	54	49	42	44	35	60	30	0	78	12	28
7	59	33	25	54	23	43	43	53	61	29	5	79	11	27
8	59	25	26	53	56	44	43	10	62	28	10	80	10	25
9	59	16	27	53	28	45	42	26	63	27	14	81	9	23
10	59	5	28	52	59	46	41	41	64	26	18	82	8	21
11	58	54	29	52	29	47	40	55	65	25	21	83	7	19
12	58	41	30	51	58	48	40	9	66	24	24	84	6	16
13	58	28	31	51	26	49	39	22	67	23	27	85	5	14
14	58	13	32	50	53	50	38	34	68	22	39	86	4	11
15	57	57	33	50	19	51	37	49	69	21	30	87	3	8
16	57	41	34	49	45	52	36	56	70	20	31	88	2	5
17	57	23	35	49	9	53	36	7	71	19	32	89	1	3
18	57	4	36	48	32	54	35	16	72	18	32	90	0	0

Though it be the common order of working, to know by helpe of the former Table the diſtance of two places differing onely in Longitude, yet I thinke it a more ſure way to finde it out per Tabulas Sinuum, the rule whereof is thus.

Firſt

Firſt take the difference of the two Longitudes, by ſubtracting the leſſer out of the greater, and the halfe of that ſhall be the Arch, which you haue to ſéeke in the Front of the Tables, then multiply the ſine of that Arch by the ſine of the complement of the common Latitude, and diuide the product thereof by the totall ſine, the quotient whereof you muſt ſéeke out in the Tables amongſt the ſines, and the Arch of that ſine is the one halfe of the diſtance, which being doubled ſhall bee the whole diſtance, contayning degrées of the great Circle, and euery ſuch degrée contayneth of Italian myles 60. and of Germane myles 15. and by working thus you ſhall find the diſtance betwixt Compoſtella and Conſtantinople to be 1846. Italian myles, ſuppoſing the common Latitude to be 43. degrées, and the difference of their Longitudes to bee 42. degrees 3'0. And by working by the common Table you ſhall finde the diſtance of thoſe two places to be 1827. Italian myles, as before, becauſe the common Table hath no minutes of miles but onely ſeconds, which are not to be accounted of, and in working by Appian his Table, hauing minutes of miles, you ſhall find yͤ ſayd diſtance to be 1892. Italian miles, and by Mercator his Map to be 1980. Italian miles, in whoſe Map, the common Latitude of the ſayd two places is 43. and the difference of their Longitudes is 44.0'. And by the ſcale ſet downe in Plancius his Map, you ſhall find the diſtance to bée 2520. Italian miles, in which Map the common Latitude of the two foreſaid places is 42. degrées 3'0. & the diffrence of their longitudes is alſo 42. degrées 3'0. Truly I muſt néeds confeſſe, that it is not ſo eaſie to make a ſcale or trunke for a Map or a Carde drawne in Plano, as for that which is drawn vpon a round body or Globe, & therefore it is no maruell though the ſcales of Maps drawn in Plano, and likewiſe the trunkes ſet down in the Mariners Cards, do not alwayes ſhew the true diſtance of places, which I beléeue is to bee done as truly, and a great deale more readily by my friend Maſter Wright his Semi-circle before deſcribed, then by the Rules of Gaſparus Peucerus in his Booke de dimenſione terræ, which Rules doe depend vpon the knowledge of the quantitie of the Angles, & ſides of Sphericall Triangles,

which

which kind of working is indéed more troubleſome and tedious then readie or pleaſant. But if Maſter Wright would make his Semicircle an vniuerſall Inſtrument, to find out thereby all the thrée kinds of diſtances, as hee promiſed mee to doe, there were no way in mine opinion worthy to bee compared vnto it, neither for the trueneſſe, eaſineſſe, nor readineſſe of working thereby.

A VERIE BRIEFE AND MOST PLAINE DESCRIPTION OF M^r. BLAGRAVE his Aſtrolabe, which he calleth the *Mathematicall Iewell.*

TOGETHER WITH DIVERS
vſes thereof, and moſt neceſſarie
for Sea-men.

Written by M^r. BLVNDEVILL.

LONDON,
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To the Reader.

OF Aſtrolabes I haue neuer ſeene but three ſorts, Firſt, that of *Stofflerus*, which for theſe hundred yeares paſt or thereabouts hath beene had in moſt price and eſtimation, as an Inſtrument contayning all the vſes, or at leaſt the moſt part of all other Mathematicall Inſtruments, which becauſe it requireth almoſt for euery ſeuerall Latitude a ſeuerall Table, *Gemma Friſius* inuented ſince another kind of Aſtrolabe, hauing but one Table to ſerue for all Latitudes, and therefore he called it the *Catholicon*, that is to ſay, an vniuerſall Aſtrolabe, which hath alſo bin moſt eſteemed and vſed many yeares. Since whoſe time, and of very late yeares, one of our owne Countrymen, a Gentleman of Redding beſides London, called M. *Blagraue* hath greatly augmented the ſaid *Catholicon*, and hath thereby as it were newly inuented a third kinde of Aſtrolabe, which he calleth the Mathematicall Iewell, whereby are to bee wrought more Concluſions then by any other one Inſtrument whatſoeuer, for which his moſt excellent inuention vſed therein, he deſerueth great commendation. And to the intent that others which haue not beene exerciſed in ſuch things, might the more eaſily attaine to the better vnderſtanding of the ſaid Iewell; I haue made a plaine deſcription of all the parts belonging to the ſaid Iewell, without committing any offence (I hope) to the Author thereof, to the intent that euery Gentleman might haue the perfect knowledge and vſe of ſo worthy an Inſtrument. But broad Aſtrolabes though they bee thereby the truer, yet for that they are ſubiect to the force of the winde, and thereby euer moouing and vnſtable, are nothing meete to take the Altitude of any thing, and eſpecially vpon the Sea: which thing to auoyde, the Spaniards doe commonly make their Aſtrolabes or Rings narrow and weighty, which for the moſt part are not much aboue fiue inches broad, and yet doe weigh at the leaſt foure pound, & to that end the lower part is made a great deale thicker, then the vpper part towards the Ring or handle. Notwithſtanding moſt of our Engliſh Pilots that bee skilfull, doe make their Sea Aſtrolabes or Rings ſixe or ſeuen inches broad, and therewith very maſſiue and heauie, not eaſie to be mooued with euery wind, in which the ſpaces of the degrees bee the larger, and thereby the truer, of which kinde of Aſtrolabes or Rings, I ſhall ſpeake hereafter in my Treatiſe of Nauigation, and alſo of the Mariners Croſſe-ſtaffe. But whenſoeuer you haue to take the Altitude of the Sun, or of any other ſtarre, be it wandering or fixed, I would wiſh you to vſe the Mariners heauy and maſſiue Aſtrolabe, which in mine opinion for that purpoſe is the fitteſt and moſt aſſured Inſtrument of all others; and to finde out all other concluſions, by helpe of Maſter *Blagraue* his Iewell, or rather by helpe of the Celeſtiall Globe, which for Aſtronomicall matters is the perfecteſt Inſtrument of all, in which are contayned all the ſtarres both Southerne and Northerne that haue bin heretofore knowne; and thoſe that are lately knowne, or ſhall bee knowne hereafter, may bee eaſily placed therein: which thing cannot be ſo wel performed in any Aſtrolabe, were it neuer ſo great. But becauſe the Globe is cumberſome and not portable, and therewith coſtly; and eſpecially if it bee of any greatneſſe (for the greater the better) and alſo if it chance to be broken in any part of the bodie thereof, it can neuer be made againe perfectly whole, it is therefore no meete inſtrument for euery Mariner to haue, but onely for ſuch as bee of good abilitie, in ſteed whereof to find out many neceſſarie Concluſions. Maſter *Blagraue* his Mathematicall Iewell may ſerue very well, and eſpecially, if it had on the backe part the like matter and *Rete*, or Net, to ſerue the South Latitude of the World, as it hath in the fore part to ſerue the North Latitude: for then I beleeue verily, that the chiefeſt Southerne ſtarres, as the Croſſe, the Southerne Triangle, *Noahs* Doue or Pigeon, & another called Poloplilax, lately foũd out by ſuch as haue trauelled by Sea on the South ſide of the Equinoctiall, might eaſily bee placed by Maſter *Blagraue* in that *Rete*, hauing once learned of the skilfull Sea-men the true Longitude, Latitude, and declination of the Starres, ſo ſhould his Iewell in myne opinion bee much more ſeruiceable to the Sea-men, then now it is, by reaſon that thoſe few Southerne Starres that be contayned in the firſt Net, are nothing ſo nigh vnto the South Pole, as the Northerne Starres, deſcribed in his firſt Net, are vnto the North Pole, amongſt which Northerne Stars, it were very neceſſary for the Sea-men, that the ſeuen principall Starres as well of the great Beare, as of the little Beare, were all duly placed in his firſt Net. Truly, if M. *Blagraue* his affaires would ſuffer him to take paines herein, I beleeue that his Iewell ſhould not be much inferiour to the celeſtiall Globe, which indeed it repreſenteth, and in ſo doing he ſhould greatly profit the Sea-men, and deſerue thereby great good will and commendations at their hands.

What this word Aſtrolabe ſignifieth.

BEfore I beginne to deſcribe vnto you the ſayd Inſtrument, and all other parts thereof, it ſhall not be amiſſe to ſhew you what this word Aſtrolabe ſignifieth.

This word Aſtrolabe is as much to ſay as the handle or inſtrument of the ſtars, by helpe wherof the manifold motions and apparances of the heauens and of the ſtars therin contayned, are knowne, and it is called of ſome a Planiſpheare, becauſe it is both flat and round, repreſenting the Globe or Spheare, hauing both his Poles clapt flat together: the ſhape or figure of which inſtrument I doe not heere ſet downe, becauſe the inſtrument it ſelfe is to bee had for a ſmall price in diuers places of London, which if you lay before you, when you minde to reade this my Deſcription thereof heere following, I doubt not but that you ſhall find euery part thereof ſo plainly explayned, as you ſhall need no other Teacher to inſtruct you therein, or to helpe you to vnderſtand any of theſe Concluſions that are to be wrought by that Inſtrument, and eſpecially thoſe which I haue here ſet downe, ſuch as the Table following ſheweth, and as I thought moſt meete for Sea-men to know, and being throughly exerciſed in them, you ſhall the more eaſily vnderſtand the manifold and neceſſarie Concluſions ſet downe by Maſter *Blagraue* himſelfe in his owne Booke, which Booke I would wiſh you to buy, and earneſtly to ſtudie the ſame. But now I will firſt deſcribe the ſayd Inſtrument, and then ſhew the vſe thereof by ſo many Concluſions as are contayned in the Table heereafter following.

THE DESCRIPTION OF Mr. BLAGRAVE his Aſtrolabe, otherwiſe called the Mathematicall IEWELL.

THis Aſtrolabe is diuided into two parts, whereof the one is called the fore-part, and the other the backe part. The forepart contayneth two principall parts, that is, the Mater, which is vnmoueable, and the Rete which is moueable. Againe, the Mater is enuironed with a great Circle, called the Meridian, paſſing through the two Poles of the World, marked with the Letters A. B. and through the two Solſticiall points of Cancer and Capricorne, marked with the Characters belonging to thoſe two Signes, and therefore may very wel be called the Colure of ẏ two Solſtices. And this circle is diuided by two croſſe diameters into foure quarters, euery quarter contayning 90. degrées, ſo as the whole Circumference of the Circle is 360. degrées, which degrées doe procéed from 90. to 90.

Now as touching the two croſſe Diameters, the one paſſing through the Center, and alſo through the two Poles, is the Axeltrée of the World, ſignifying ſomtime the firſt Meridian, and ſomtime the right Horizon, and ſometime the Line of ſix houres, as well for the Morning as Euening, and then it is the Line of Eaſt and Weſt, and ſometime the Line of North and South.

And the other croſſe Diameter drawne with red Inke, ſignifieth moſt commonly the Equinoctiall, and ſometime the line of

Eaſt and Weſt,and ſomtime the line of the North and South, and eſpecially when you haue to find out the 12.houſes of heauen, to which end are ſet downe in yͤ outermoſt Meridian theſe foure Latine words, firſt at the North Pole marked with the letter A.Oriens,which is as much to ſay as the Eaſt part: and at the South Pole marked with the letter B. Occidens, which ſignifieth the Weſt part:and at the end of the ouerthwart Diameter, drawn with red Inke, & moſt commonly ſignifying the Equinoctial, marked with the letter C.on the right hand is ſet downe Culmen Cœli,the higheſt part of Heauen, which is the South,at which end the Ring or handle is faſtned. And at the other end of the ſayd Diameter, marked on the left hand with the letter D.is ſet down Imum Cœli,the loweſt part of heauen, which is yͤ North.And by theſe two croſſe diameters the whole matter is diuided into foure quarters, that is, Northeaſt and Southeaſt, Northweſt and Southweſt. The Northeaſt quarter lyeth betwixt Imum Cœli,and the vpper end of the Areltrée, whereon is written Oriens. And the Southeaſt quarter lyeth betwixt the ſame point and Culmen Cœli, and the Southweſt quarter lyeth betwixt Culmen Cœli and the lower end of the Areltrée, whereon is written Occidens,and the Northeaſt quarter lyeth betwixt the point Occidens and Imum Cœli.

The Meridians & houre-lines to the Mater.

Beſides theſe two croſſe diameters,the Mater is traced with 180.Meridians,which do paſſe through both the Poles,whereof the firſt paſſing through the Center from Pole to Pole, is the Collure of the Equinoxes, becauſe it paſſeth through the firſt point of Aries, and the firſt point of Libra, & is otherwiſe called the Areltrée and ſignifieth ſometime the right Horizon, & ſometime the firſt Meridian, from which vpon the Equinoctiall are counted the degrées of Longitude both Eaſt and Weſt. And all the foreſaid Meridians are moſt cōmonly vſed as houre-lines: for euery 15. Meridian, counting from the Limbe, doth ſignifie one houre, for 15.degrées do make an houre, & foure minutes do make a degrée. And theſe houres at the end of euery 15. Meridiā are marked in the body of the Mater ſomwhat about the Tropick of Cancer with Arithmeticall figures, procéding from one to 12. forward towards the right hand, and againe are marked ſomewhat beneath the Tropique of Capricorne with like figures, procéding backward towards the left hand. Whereof the vpper numbers doe ſignifie the fore-noone houres, and the lower numbers the after-noone houres, and are placed ſo, as one ſelfe houre-line doth paſſe through both numbers: for the line of the 11. houre in the fore-noone ſerueth alſo to the firſt houre in the after-noone, and the fore-noone houre of 10. ſerueth alſo to the houre of 2. in the after-noone, and the fore-noone of 9. ſerueth to the houre of 3. in the after-noone: and the fore-noone houre of 8. ſerueth to the houre of 4. in the after-noone, and the fore-noone houre of 7. ſerueth to the houre of 5. in the after-noone, & the fore-noone houre of 6. ſerueth alſo to the 6. houre in the after-noone: and from thence-forth towards the left hand, 5.ſerueth to 7. 4.to 8. 3.to 9. 2.to 10. and 1.to 11.as before.

How to find out the Horizon of euery ſeuerall Latitude.

The Parallels of the Mater.

The two Tropiques.

But whenſoeuer you haue to find out any houre amongſt the houre-lines in the Mater, remember, that the Arletrée which paſſeth through the Center,and alſo through both the Poles, is alwayes the firſt houre both of the Morning and Euening, from which you ſhall the more eaſily find out any houre that you ſéek, by allowing 15. Meridians to euery houre, as is before ſaid. And you haue to note, that all theſe Meridians do ſometime ſignifie euery one a ſeuerall oblique Horizon, ſauing that the firſt Meridian or Arel-trée ſignifieth the right Horizon, as hath béen ſaid before. And to find out in the Mater the Horizon of euery Latitude, reckon from the Arletrée on both hands, ſo many Meridians as may make vp the number of degrées of your Latitude, and that Meridian ſhall be your Horizon. In counting of which Meridians, you ſhall find, that euery fifth Meridian is drawn with a greater black line then the reſt. Now ouerthwart theſe Meridians are drawne 180.Parallels, which procéed from 1.to 90. whoſe numbers are ſet downe in the Limbe of the Mater thus, 10.20.30.40. and ſo forth, both vpward & downeward, vntill you come to 90. and theſe Parallels are otherwiſe called the Circles of Declination, as well of the Sun as of any ſtarre. Amongſt which there be two Parallels painted red, whereof that towards the North Pole ſignifieth the Tropique of Cancer, and the other towards the South Pole the Tropique of Capricorne.

The Ecliptique Line of the Mater.

pricorne. Then there is another oblique ouerthwart red Line, which paſſing through the Center from Tropique to Tropique, ſignifieth the Ecliptique Line, nigh vnto which, on each ſide are ſet downe the Characters of the twelue Signes, whereof Aries and Libra are placed at the Center, and Cancer at the one end of the Ecliptique on your right hand, whereas it toucheth the ſaid Tropique, and Capricorne at the other end of the ſaid Ecliptique on your left hand, whereas it toucheth the ſaid Tropique of Capricorne: and the reſt of the Signes are orderly placed betwixt the ſaid Tropiques, euery two Signes one againſt another, that haue like declination, as Gemini and Leo, Taurus and Virgo, which are placed betwixt the Center and Cancer, then Piſces and Scorpio, and Aquarius and Sagittarius are placed betwixt the Center & Capricorne. And euery Signe contained in the Ecliptique Line, is diuided with ſlanting back ſtreekes into 15. ſpaces, euery ſpace containing two degrees, which maketh 180. degrees, and being doubled, becauſe the ſpaces are to be counted both forward and backward, doe make in all 360. degrees, which is the whole Circuit or Longitude of the Ecliptique, and the degrees of the ſaid Ecliptique are larger towards the Limbe then towards the Center, whereby the ſpaces betwixt Signe and Signe are not equall, but ſome larger then otherſome.

The Limbe of the Mater.

And note, that vpon the outermoſt Limbe of the Mater, are drawne three Circles, making two reaſonable ſpaces, both which ſpaces are diuided into 360. degrees, both of them beginning at the North Pole. And the degrees in the outermoſt ſpace of the Limbe beginning at the North Pole, doe proceed from 15. to 15. downeward towards your left hand, and ſo round about the Inſtrument, vntill you come to 360. which degrees doe ſhew the houres of the Equinoctiall. And at the North Pole, whereas the diuiſion beginneth, is ſet downe the figure of 6. ſignifying the 6. houres of the fore-noone, then counting 15. degrees downeward towards your left hand, is ſet downe in the foreſaid ſpace the figure of 5. then 4. 3. 2. and 1. And at the end of the Equinoctiall, on the left hand, is ſet downe 12. from which proceeding ſtill downewards, are ſet theſe numbers of houres,

11.10.

11. 10. 9. 8. 7. and 6. which 6. ſtandeth at the South Pole: then from thence proceeding vpwards, are ſet downe theſe houres, 6. 5. 4. 3. 2. 1. and then 12. which ſtandeth at the end of the Equinoctiall on the right hand: from whence proceeding ſtill vpwards towards the North Pole, are ſet downe theſe houres, 11. 10. 9. 8. and 7. and at the Pole it ſelfe is ſet downe the figure of 6. as before hath beene ſaid, from whence you firſt began to count. And in the inner ſpace of the ſame Limbe, the 360. degrees are to be counted by 90. in ſuch ſort, as the firſt 90. is placed at the North Pole, the ſecond 90. at the one end of the Equinoctiall, marked with C. the third 90. at the South Pole, marked with B. and the fourth 90. at the other end of the Equinoctiall, marked with D. Euery which quarter is to be counted both vpward and downeward, according as you ſee the Numbers written with Arithmeticall figures, and are placed one aboue another in the ſaid ſpace, whereof the vpper figures are ſomewhat leſſer then the nether figures, both of them proceeding from 1. to 90. the greater figures from the Equinoctiall vpward to the very Pole, and the leſſer figures from the Pole downeward to the Equinoctiall, and are thus ſet downe, 10. 20. 30. 40.

A deſcription of the Nette, called in Latine Rete.

This part is firſt inuironed round about with a great Circle, ſignifying moſt commonly the Meridian or 90. Azimuth or Verticall Circle, and ſometime it ſignifieth the Equinoctiall, & eſpecially when the Center is taken for the Pole: which Circle is diuided by two croſſe Diameters into foure quarters, euery quarter containing 90. degrees, which degrees are to be numbred in the very Limbe of the Rete both vpward & downeward: and of theſe two croſſe Diameters, the one end marked with the Letter A. ſignifieth the Zenith, and the other end marked with the Letter B. ſignifieth the Nadir or point oppoſite, and the

the other Croſſe Diameter, marked with the Letters C.D. ſigniſieth the Horizon, which for diſtinctions ſake is otherwiſe called the Finitor, becauſe the Meridians, before deſcribed in the Mater, are to be called and vſed ſometimes as Horizons: and this Finitor is a pretty broad Ruler, the very edge whereof is diuided with ſmall diuiſions into 180. degrées, which being doubled, by reckoning the ſame both forward and backward, (beginning at the Center) doe make vp 360. degrées.

The Finitor.

This Finitor ſigniſieth the Horizon of the Globe, the very edge whereof being diuided by little ſhort ſtrékes into ſmall portions or degrées, is alwayes to be applyed to any ſeuerall Latitude when néed is, and the broader part thereof ſerueth only to containe the numbers that are ſet therein both beneath and aboue, to know thereby the number of euery Azimuth hereafter deſcribed, which numbers doe procéed from the Center to the right hand thus, 10. 20. 30. 40. 50. and ſo forth to 90. Then backward towards the Center are ſet downe 100. 110. 120. 130. 140. and ſo forth, vntill you come to 180. which is placed at the very Center. Then from thence towards the left hand are ſet downe theſe numbers, 190. 200. 210. and ſo forth, vntill you come to 270. and from thence turning againe towards the Center, are ſet downe 280. 290. and ſo forth, vntill you come to 360. placed at the Center.

The Almicanteraths.

And in the ſaid Net are certaine Circles, which are Parallels to the foreſaid Finitor, procéeding towards the Zenith, and are in euery reſpect like vnto the Parallels deſcribed in the Mater, and theſe Parallels are called Almicanteraths, that is to ſay, Circles of Altitude, which beginning at the Finitor, doe procéed to the Zenith, marked with the Letter A. from 1. to 90. And though there be cut out in the Rete but 30. Almicanteraths, yet foraſmuch as euery ſpace contained betwixt euery two Almicanteraths, doe containe thrée degrées, they make in all 90. for thrée times 30. maketh 90. which degrées you may ſée ſet downe in the Limbe of the Rete on both hands thus, 10. 20. 30. and ſo forth, till you come to 90. which ſtandeth at the very Zenith.

The Azimuths

And theſe Almicanteraths are croſſed with other circles called

Azimuths,

Azimuthes, that is to ſay, Vertical Circles, which paſſing from the Finitor, doe méet all in the Zenith, whereof though in this Inſtrument there be ſet downe but 12. being 15. degrées diſtant one from another, yet you muſt imagine that there be 180. which the degrées ſet downe in the Finitor, in ſuch manner as is before deſcribed, doe ſhew. And you haue to note, that if the Sunne be in the very beginning of the Azimuthes, which is at the Center, then is he full Eaſt, and if he be in the 90. Azimuth, then he is full South, and when he is in the 180. then he is full Weſt, and when he is in the 270. Azimuth, then he is full North.

How to count the Azimuths, according to the Mariners Compaſſe.

And if you would haue this account of the Azimuthes to anſwere the Mariners Compaſſe, then diuide the number of the Azimuthes wherein the Sunne is, by 11. degrées $\frac{1}{4}$. which is 15. minutes, and the quotient will ſhew the Rombe or Wind of the Mariners Compaſſe, ſo as in your account you procéed from the firſt Azimuth towards your right hand, that is, from Eaſt to South, and from South to Weſt, and from Weſt to North, and ſo from thence again to the Eaſt point, whereas you firſt began. Alſo you haue to note by the way, that theſe Azimuthes do ſomtime ſigniſie the Circles of poſition, the vſe whereof you ſhal find ſet downe hereafter in the 31. Propoſition of this Treatiſe.

The deſcription of the Zodiaque of the Rete.

In the meane time I will procéed in deſcribing the Zodiaque of the Rete, which in ſhape is like to an Egge, called in Latine Figura oualis, the one halfe whereof extendeth towards the Zenith, and the other towards the Nadir or point oppoſite to the ſaid Zenith, in which Circle are placed 12. Signes, whereof the ſix Northerne Signes, that is, Aries, Taurus, Gemini, Cancer, Leo, and Virgo, are placed in the nether halfe towards the Nadir, and the other ſix Southerne Signes, that is, Libra, Scorpio, Sagitarius, Capricornus, Aquarius, and Piſces, are placed in the vpper halfe of the Zodiaque towards the Zenith, and euery one of theſe Signes are diuided into 30. degrées, which are ſet downe with Arithmeticall figures in the ſaid Zodiaque thus, 10. 20. 30.

Of ſtarres 71. contained in the Rete.

Moreouer, in the ſaid Net are placed certaine fixed ſtarres, to the number of 71. whoſe names here do follow. Caput Ophinci, that is the head of Serpentarius, Aquila, the Eagle, Caput En-

gon,

gon, the head of Hercules. Cuſpis Sagittarii, the ſhaft of Sagittarius, Palma Ophinei, the hand of Serpentarius. Cauda Delphini, the tayle of the Dolphin, Romboides Delphini, which is a ſtarre in the Dolphins backe. Cor Scorpionis, the heart of the Scorpion, Frons Borealis, Media, and Auſtralis Scorpionis, the Northerne, Southerne, and middle Front of Scorpio. Lucida Lyræ, the bright ſtarre of Lyra, or Vultur cadens. Lanx Chelæ Borealis & Auſtralis, the North & South ſtarre of the Ballance. Corona Gnoſiæ, the Crowne of Ariadna. Præcedens & ſequens caudæ Capricorni, that is, the former and follower in the tayle of Capricorne. Caput Draconis; the head of the Dragon. Haſtile Bootis, the Bore-ſpeare of Arcturus. Cauda Cygni, the tayle of the Swanne. Fomahand, a ſtarre in the mouth of the Southerne Fiſh. Arcturus; a ſtarre betwixt the legges of Bubulcus or Bootes. Humerus Bootis, the ſhoulder of Bubulcus. Dexter Humerus Cephei, the right ſhoulder of Cepheus. Crus Pegaſi, the Legge of the winged Horſe. Spica Virginis, the Wheat eare in the hand of Virgo. Tres ſtellæ in cauda Vrſæ maioris, thrée ſtarres in the tayle of the great Beare. Preuindemiatrix, that is, Virgo. Cauda Ceti, the tayle of the Whale. Andromedæ Scapulum, the ſhoulder blade of Andromeda, Cingulum Andromedæ, the girdle of Andromeda. Humerus Vrſæ maioris, the ſhoulder of the great Beare. Corui roſtrum, the beake of the Crow. Corui ala dextra, the right wing of the Crow. Cauda Leonis, the tayle of the Lyon. Ceruix Leonis, the necke of the Lyon. Cor Leonis, the heart of the Lyon, otherwiſe called Regulus. Lucida Hydræ, the bright ſtarre of Hydra. Capita Geminorum, the heads of the two Twinnes, named Apollo and Hercules. Cancer, the Crabbe. Canis minor, the little Dogge. Canis maior; the great Dogge. Canopus, a faire ſtarre in the left Oare of the ſhip Argus. Humerus dexter Aurigæ, the right ſhoulder of Auriga. Hircus, the Goat hanging at the backe of Auriga. Hedi, the two little Goats ſucking behind at her paps. Humerus dexter Orionis, the right ſhoulder of Orion. Tres ſtellæ in cingulo Orionis, thrée ſtarres in the girdle of Orion. Humerus ſiniſter Orionis, the left ſhoulder of Orion. Pes ſiniſter Orionis, the left foot of Orion. Oculus Tauri, the Bulls eye.

Pleiades,

Pleiades, the ſeuen little ſtarres in the Bulls necke. Extremum Eridani, the laſt end of the Floud Eridanus. Caput Meduſæ, the head of Meduſa. Dextrum latus Perſei, the right ſhoulder of Perſeus. Cornu Arietis, the former ſtarre of the Rams horne. Venter Ceti, the Belly of the Whale. Iuba Ceti, the Mane of the Whale.

How to know which ſtarres be North or South.

And note, that all theſe ſtarres in the Nette, whoſe longeſt tippes or points doe point from the Center outward towards the Limbe, are Northerne ſtarres, hauing North declination, and thoſe whoſe longeſt tippes do point inward from the Limbe towards the Center, are Southerne ſtarres, hauing Southerne declination. All which ſtarres are ſet downe in a Table in the beginning of his third Booke, which doth not onely ſhew their names, but alſo their Longitudes, Latitudes, and declinations, their natures, their right Aſcenſions and Magnitudes, or greatneſſe. And whereas both in the Mater, and alſo in the Rete, one ſelfe Circle is made to haue diuers ſignifications, the cauſe thereof ſhall plainely appeare vnto you by the vſe of the Aſtrolabe, in ſéeking to find out thereby the Propoſitions of the foreſaid Booke.

A deſcription of the Labell.

And beſides the parts before deſcribed, there is yet another part belonging to the forepart of the Inſtrument, called the Labell, the one end whereof is faſtned to the Center of the Aſtrolabe, ſo as it may turne round about. And this Labell is diuided into 90. degrées, twice ſet downe therein with Arithmeticall figures, to be reckoned as well from the Center to the point of the Labell, as from the point thereof to the Center, ſeruing to diuers vſes, yea the 90. degrées of the Labell are ſometimes to be repeated foure times, to make vp the number of 360. degrées, as ſhall hereafter plainly appeare by the 12. Propoſition, ſhewing how to find out the right aſcenſion of any degrée or portion of the Ecliptique line.

The fiduciall line of the Labell.

And remember, that the right line, drawne from the Center of the Labell alongſt the inward edge thereof, is called the Fiduciall line, and is diuided into 90. ſmall parts, called degrées, which line or inward edge is alwaies to be vſed in any Propoſition, and not the outward edge or backe part of the Labell.

Thus

Thus much touching the fore-part of M. Blagraue his Iewel, with euery particular part thereof: with which fore-part I wiſh you to be throughly acquainted, before you deale with the Propoſitions here following, or with any other Propoſition contained in M. Blagraue his Booke.

A briefe deſcription of the backe part of the ſaid Iewell.

IN the Limbe of the backe part is deſcribed the Theorique of the Sun, to know thereby in what Signe & degrée the Sun is euery day throughout the yéere, by laying the Diopter thereto. M. Blagraue calleth it a Ruler: which Diopter is made with two Pinules or ſquare Tablets, each one pierced with two holes, one greater then another, the leſſer to take the height of the Sun, by his beame paſſing through the ſaid leſſer holes, and the greater holes doe ſerue to take the altitude of the Sun, being ſomewhat darkned in the day time, ſo as he caſteth no beame, or elſe the altitude of any ſtarre in the night ſeaſon, by looking with your one eye, the other being ſhut, through the two greater holes of the Pinules or Tablets. And the midſt of this Diopter is faſtned with a pinne to the Center of the Aſtrolabe, ſo as the ſaid Diopter may turne round about, and the middle line of the ſaid Diopter is called the Fiduciall line, becauſe it rightly directeth the ſight of the eye to the foreſaid holes. The degrées of the altitude of the Sun, or of any ſtarre, are ſet downe in the outermoſt ſpace of the Limbe, diuided by two croſſe Diameters into foure quarters, euery quarter containing 90. degrées, the number of which degrées are ſet downe in the outermoſt ſpace of the Limbe of the ſaid backe part with Arithmeticall figures, right ouer the heads of the ſaid degrées of altitude. And you haue to note, that the perpendicular Diameter ſignifieth the Meridian, that is, the Line of South and North, that is to ſay, the South point at the ring or handle, and the North at the point oppoſite, and the other ouerthwart Diameter ſignifieth the right Horizon, that is to ſay, the line of the Eaſt and Weſt, the Eaſt being placed on the left hand, and the Weſt on the right hand. And vnder the Theorique of the Sunne you may draw as many Circles, of ſuch reaſonable diſtance one from another, as in the ſpaces thereof may be ſet downe the yeares of our Lord, the Dominicall letter for the leape yeare, and the Dominicall letter for the common yeares, the Prime or Golden number, the Epact, and on what day of March or of Aprill Eaſter day euery yeare falleth, in ſuch order as Maſter Blagraue hath himſelfe deſcribed in a Table made of purpoſe in the ſecond booke of his Iewell, the 11. Chapter.

Thus hauing deſcribed euery particular thing, as well in the forepart as in the backe part of the ſaid Inſtrument, I will now ſhew you how to vſe the ſame, and how to find out thereby all the concluſions contained in the Table héere next following.

The Table containing 32. neceſſarie Concluſions to be wrought by this Aſtrolabe.

FIrſt how to finde out the place of the Sunne (that is to ſay) in what ſigne and degree thereof the Sunne is euery day throughout the yeare, being not leape yeare, and alſo the oppoſite point of that degree. Propoſition. 1.

How to know the place of the Sunne in the leape yeare, and how to finde the leape yeare. Prop. 2.

How to take the Altitude of the Sunne or of any ſtar. Prop. 3.

How to take the Meridian Altitude, that is to ſay, the higheſt or greateſt Altitude of the Sunne or any ſtarre. Prop. 4.

How to know the Altitude of the Sunne at any houre without ſeeing the Sunne. Prop. 5.

How to know the Meridian Altitude of the Sunne, or of any ſtar in the Net, without ſeeing them. Prop. 6.

How to know the declination of the Sunne, or of any ſtarre contained in the Net. Prop. 7.

How to finde out the Latitude of any Region diuers waies. Prop. 8.

How to know the houre of the day by the Sunne, and alſo in what part or coaſt of heauen he is at that inſtant. Prop. 9.

How to find the riſing and ſetting of the Sunne euery day in euery Latitude, and thereby the length of the day, and alſo in what coaſt or part of the Horizon he riſeth and ſetteth. Prop. 10.

How to know euery day at what houre the Moone riſeth and ſetteth, and how long ſhe continueth aboue the Horizon, and alſo when ſhe is full South. Prop. 11.

How to find out the right aſcenſion of the Sunne, or of any degree or portion of the Ecliptique. Prop. 12.

Another more ready way to find out the right aſcenſion of any degree or portion of the Ecliptique by the Rete. Prop. 13.

How to find out the aſcenſionall difference of the Sunne, or of any degree or point of the Ecliptique. Prop.14.

How to find out the oblique aſcenſion of the Sunne, or of any point of the Ecliptique. Prop.15.

How to find out the right aſcenſion of any Arke or portion of the Ecliptique, and therewith to know what time it ſpendeth in riſing in a right Sheare. Prop.16.

How to find out the oblique aſcenſion of any Arke of the Ecliptique in any Latitude, & what time it ſpendeth in his riſing. Prop. 17.

How to find out the oblique deſcenſion of any point of the Ecliptique in any Latitude. Prop.18.

How to find out the oblique deſcenſion of any Arke giuen of the Ecliptique, and therwith to know the time which it ſpendeth in his ſetting. Prop.19.

How to know the height of any ſtarre at any houre without ſeeing the ſtarre, and thereby to find out in the firmament all the ſtarres that be deſcribed in the Net, and are to be ſeene with the eye. Prop.20.

How to finde out the aſcenſionall difference of any ſtarre. Prop. 21.

How to know the oblique aſcenſion of any ſtarre. Prop.22.

How to know what ſtarres doe neuer riſe nor ſet in any Latitude. Prop.23.

How to know at what houre of the day or night any ſtarre riſeth or ſetteth. Prop.24.

How to know how long any ſtarre continueth aboue the Horizon in euery Latitude. Prop.25.

How to find out the ſtarres houre, and thereby to know the houre of the night. Prop.26.

How to finde out the diſtance betwixt any two ſtarres contained in the Net. Prop.27.

Another way to know the diſtance of any two ſtars, their Longitudes & Latitudes being firſt knowne, and alſo by that meanes to finde out the diſtance betwixt any two places vpon the earth. Prop. 28.

How to find out the degree of *Medium Cœli* at any houre of the day, that is to ſay, the degree of the Zodiaque that is in the Meridian at any houre that you ſeeke, and alſo the degree called *Imum Cœli*. Prop.29.

How to find out the Horoſcope or aſcendent at any time of the day or night, and thereby to haue the foure principall Angles of heauen. Prop.30.

How to find the Circles of poſition, and to know how much the Pole is eleuated aboue euery ſuch Circle in any Latitude, without the knowledge whereof you cannot find out the 12. houſes by this Aſtrolabe. Prop.31.

How to find out all the 12. houſes of heauen, and thereby to erect a figure at any houre of the day or night. Prop.32.

PROPOSITION. I.

The vſes of the Aſtrolabe, and firſt how to find out the place of the Sunne (that is to ſay) in what ſigne and degree thereof the Sunne is euery day throughout the yeare, being not leape yeare, and alſo the oppoſite point of that degree.

LAy the Diopter which is on the backſide of the Aſtrolabe vpon the day of the moneth, and that end of the Diopter with his fiduciall line will ſhew you in what ſigne and degrée thereof the Sunne is that day, and the other end of the Diopter will ſhew you the oppoſite point to that degrée. As for example, I would know the place of the Sunne the 17. of Iuly: hére by laying the Diopter vpon that day, I find the Sunne to be in the fourth degrée of Leo, and the oppoſite point thereof to be the fourth degrée of Aquarius.

PROPOSITION. II.

How to know the place of the Sunne in the leape yeare, and how to find the leape yeare.

WHen it is leape yeare you muſt alwaies adde one degrée more euery day during that yeare vnto the place of the Sunne found by the firſt Propoſition, which leape yeare you ſhall know by diuiding the yeare of the Lord by 4. for if there be no remainder left, then that yeare is leape yeare, ſo ſhall you find the yeare of our Lord 1596. the leape yeare,

PROPOSITION. III.

How to take the Altitude of the Sunne, or of any ſtarre.

TO take the Altitude in any time of the day when the Sunne ſhineth, you muſt turne your face and alſo the left Tablet or Pinule of the Diopter towards the Sunne, holding the Aſtrolabe by the ring with your right for-finger or middle-finger, being ſomewhat bowed, in ſuch ſort as the Aſtrolabe may hang plumbe, and then with your left hand lift the Diopter vp and downe vntill the Sunne with his beame doe iuſtly ſtréeke through the holes of each Pinule of the Diopter; ſo as you may ſée the ſhadow of the two holes of the vpper Pinule, to play vpon the two holes of the nether Pinule, then marke vpon what degrée of Altitude the thinneſt edge or Fiduciall line of the Diopter falleth in the outermoſt ſkirt or border of the backe of the Aſtrolabe, for that is the Sunnes Altitude for that preſent. But if the Sunne be couered with a cloud, ſo as it ſhineth not cleare enough to caſt any ſhadow, and yet ſo as it may be ſéne with the eye, then hang the Aſtrolabe by the ring vpon your right thumbe, and turning your face towards the Sunne, lift vp your hand with the Aſtrolabe ſo high, as by mouing the Diopter with your left hand vp and downe, you may with your right eye (the other being ſhut) ſée the Sunne through the greater holes of both the Pinules of the Diopter, and marke vpon what degrée of Altitude the vpper end of the Diopter falleth, and that is the Altitude of the Sunne at that time, and in this manner you muſt alſo take in the night ſeaſon, the Altitude of any ſtarre.

PROPOSITION. IIII.

How to take the Meridian Altitude, that is to ſay, the higheſt or greateſt Altitude of the Sunne or of any ſtarre.

GOe into ſome open place whereas the Sun ſhineth ſomewhat before noonetide, and there hanging the Aſtrolabe vpon your right fore-finger, or middle finger take the Altitude of the Sun in ſuch manner as is before taught, at diuers times, with ſome pawſe betwixt euery time to know therby whether ſuch Altitude increaſeth or decreaſeth, for if it increaſeth, then yͤ Sun is not yet at the Meridian, but if it decreaſeth, then it is paſt the Meridian, and therefore you muſt watch diligently to take him when he is at the higheſt. And you muſt doe the like to take in the night ſeaſon, the Meridian Altitude of any knowne ſtarre, ſauing that then you muſt hang your Aſtrolabe vpon your thumbe before your right eye, and doe as is taught in the laſt Propoſition.

PROPOSITION. V.

How to know the Altitude of the Sunne, or of any ſtarre at any houre of the day, without ſeeing the Sunne or ſtarre.

SEt the Finitor at your Latitude, and ſéeke out amongſt the houre-lines or Meridians of the Mater, in what point the Parallel or Circle of declination of the Sunne croſſeth the houre-line which you ſéeke : and the Almicanterath and Azimuth paſſing through that point doe ſhew both the Altitude and alſo the coaſt or part of heauen, wherein the Sunne or Starre is at that inſtant. This is a very neceſſarie Propoſition, for by knowing the height of the Sunne at euery houre of the day in whatſoeuer ſigne the Sunne is, you

may make Tables for particular Dyals, as Cylinders, houre-Quadrants, & ſuch like, to ſerue any Latitude : yea rather this Inſtrument (as Maſter Blagraue rightly ſaith) is a Table of it ſelfe ready made to ſerue ſuch purpoſes. Let the example of this Propoſition be thus, Suppoſe that at eight of the clocke in the morning the 21. of Aprill 1592. the Sunne being then in the tenth degrée of Taurus, and his declination 15. degrées Northward, you would know the Altitude of the Sun at that houre, which by working as the Rule teacheth, you ſhall finde to be 30. degrées, and that he is about 16. degrées diſtant from the Eaſt towards the South.

PROPOSITION. VI.

How to know the Meridian Altitude of the Sunne, or of any ſtarre euery day throughout the yeare, without ſeeing either Sunne or Starre.

FIrſt ſéeke to know the declination of the Sunne or Starre, either by the ſeuenth Propoſition next following, or elſe by ſome Table, and whether it be North or South, and knowing his declination, bring the Finitor to your Latitude, and ſtaying it there, ſéeke out in the limbe of the Mater on your right hand the ſayd declination, and there marke what Almicanterath toucheth that point, for that Almicanterath being counted vpon the limbe of the Rete from the Finitor, doth by and by ſhew the Meridian Altitude of the Sun or ſtarre for that day. As for example, I would know the Meridian Altitude of the Sun yͤ firſt of July 1592. at which time his Parallel or declination is 22. degrées, and certaine minutes Northward. Héere hauing laid the Finitor to the Latitude 52. I find that the 60. Almicanterath toucheth the Parallel, and that is the Meridian Altitude of the Sun that day. Againe, ſuppoſe that I would know the Meridian Altitude of yͤ ſtar Oculus Tauri, in the Latitude 52. Here hauing brought the Finitor to the ſaid Latitude, I find that the 53. Almicanterath toucheth his Parallel or declination, which is 15. degrees 4'9. Northward, ſo as I find his Meridian Altitude in that Latitude to be 53. degrees. But you haue to note, that if the Sun or Star haue South declination, then you muſt count his Parallel from the Equinoctiall downward towards the South Pole, ſo ſhall you find the Meridian Altitude of the great dog called Canis maior, whoſe Southerne declination is 16. degrees, to 22. degrees & 3'0. And by knowing the Meridian Altitude of any ſtar, you may alſo know how far he is diſtant from the Meridian or South line, if you ſubtract from his Meridian Altitude his Altitude taken at any other time of the ſame night, for the remainder will ſhew his diſtance from the Meridian, & if the ſtar at the time of taking his Altitude, be in the Eaſt part of the firmament, thẽ he is ſo much ſhort of the Meridian, & if he be in the Weſt, then he is ſo much paſt the Meridian. As for example, knowing the Meridian Altitude of Oculus Tauri to be 53. degr. & his other Altitude newly taken to be 30. degrees, I find his diſtance from the Meridian to be 23. degrees, aſwell by ſubtraction, as by counting vpon the limbe of yͤ Rete the degrees contained betwixt the two foreſaid Almicanteraths. And becauſe the ſayd ſtarre was in the Eaſt part of the firmament when I tooke his Altitude, I conclude that he wanted 25. degrees of arriuing to the Meridian, which maketh one houre and a halfe, and a little more.

PROPOSITION. VII.

How to find the declination of the Sunne, or of any ſtar deſcribed in the Net.

This may be done two manner of waies. Firſt knowing the place of the Sunne, ſeeke his place in the Eclyptique line of the Mater, and looke what Parallel of the Mater paſſeth through that degree, and the number of that Parallell will ſhew the declination (that is to ſay) how farre the Sunne

is

is diſtant from the Equinoctial, counting from the Equinoctial vpon the vttermoſt Meridian or inner limbe of the Mater, & according as the ſigne wherein the Sun is, be it Northerne or Southerne, ſo is the declination of the Sun, & muſt be counted either vpward or downward accordingly. The ſecond way is thus: lying the Fiduciall line of the Labell to the degree of the Sun in the Zodiaque of the Net, & the number of degrees counted vpon the Label betwixt the limbe of the Net, and the place of the Sun which the Labell toucheth vpon the outward edge of the ſayd Zodiaque, will ſhew his declination. By either of theſe two waies you ſhall find the declination of the Sun, being in the 10. degree of Taurus, to be 15. degrees Northward. And by this laſt way you may know the declination of any ſtarre contained in the Net thus. Hauing found in the Net the ſtarre whoſe declination you ſeeke, lay the Fiduciall line of the Labell to the longeſt tip of that ſtarre, then count vpon the Labell how many degrees are contained betwixt the limbe of the Rete, and that point whereas the Labell toucheth the longeſt tip of the ſaid ſtar, and that ſhall be his declination either Northerne or Southerne, according as the ſaid tip pointeth either outward or inward: for if outward from the Centre, then it is Northerne, if inward towards the Centre, then it is Southerne, as hath beene ſaid before in the deſcription of the Net. And by doing thus, you ſhall find, that the ſtarre called Canis maior, that is the greater dog, hath in South declination 15. degrees 5'5. Againe you ſhall find the firſt ſtarre of the Rams horne called Cornu Arietis to haue in North declination 18. degrees.

PROPOSITION. VIII.

How to find out the Latitude of any Region.

First you muſt know the place of the Sun, and alſo his declination, and hauing taken his Meridian Altitude, reckon the ſame amongſt the Almicanterathes, from the Finitor vpwards, and turne about the Rete from the Pole Arctique towards the Equinoctiall on your right hand, vn-

till

till it toucheth the Parallel of the Sunne, for then looke on your left hand, and you ſhall find the Finitor to ſtand at that Latitude which you ſeeke. As for example, the 12. of Aprill 1591. the Sun being in the firſt degree 20. minutes of Taurus, and his declination being then 12. degrees Northward, I find his Meridian Altitude to be 50. degrees, which I count vpon the limbe of the Rete proceeding from the Finitor vpwards towards the Zenith, and then I turne the Rete vntill I haue brought that Almicanterath to the Parallel of the Sun, which is 12. degrees, counting the ſame from the Equinoctiall on the right hand of the Mater towards the North Pole, and there ſtaying the Rete, I find that on the left hand the Finitor lyeth vpon the 52. degree of Latitude, counting from the North Pole downe towards the Equinoctiall. The common way of finding the Latitude is thus, if it be in the day time, then take the Meridian Altitude of the Sunne, and if the Sunne be in any of the ſixe Northerne ſignes, then ſubtract the declination of the Sun out of his Meridian Altitude, & the remainder ſhall be the Altitude of the Equinoctiall aboue your Horizon, which being takẽ out of 90. the remainder wil ſhew the Altitude of the Pole, but if the Sun be in any of the ſix Southerne ſignes, then you muſt adde his declination to his Meridian Altitude, and the ſumme thereof ſhall be the Altitude of the Equinoctiall, which being taken out of 90. the remainder will ſhew the Latitude or eleuation of the Pole. But to know the Latitude of any place in the night ſeaſon, you muſt take the Meridian Altitude of ſome knowne ſtar which both riſeth and ſetteth: then after ẏ you haue taken his Meridian Altitude with your Aſtrolabe, you muſt learne to know his declination, & whether it be Northerne or Southerue, for if the ſtarre haue North declination, then you muſt ſubtract his declination from his Meridian Altitude, & the remainder ſhall be the Altitude of the Equinoctiall, which being taken out of 90. ſhall be the Altitude or eleuation of the Pole: but if the declination of the ſtarre bee Southernly, then you muſt adde his declination to his Meridian Altitude, & that ſumme ſhall be the Altitude of the Equinoctial, which being taken out of 90. the remainder ſhall be ẏ eleuation of the Pole. And there be diuers other waies of finding out

the

the Latitude of any place, which I haue partly ſet downe in my Treatiſe of the two Globes about the latter end thereof, and partly in my Treatiſe of Nauigation, whereas I ſpeake of the North Starre and of his guards.

PROPOSITION. IX.

How to know the houre of the day by the Sunne, and alſo in what part of Heauen he is at that inſtant.

TAke the Altitude of the Sunne, and knowing the Latitude of the place where you are, bring the Finitor of the Rete to that Latitude, and hauing ſtayed it there, looke in what point the Almicanterath or Altitude of the Sunne croſſeth the Sunnes Parallel or Circle of declination in the Mater, and the houre-line paſſing through that point will ſhew the true houre. And at that inſtant you may alſo know in what Azimuth (that is to ſay) in what part of Heauen, or as the Mariners terme it, in what Rombe or Wind, as Eaſt, Weſt, North, or South, &c. the Sun is at that inſtant, for that Azimuth which paſſeth through the fore-ſayd point, is the Azimuth of the Sunne. As for Example, the 21. of April 1592. the Sunne being in the tenth degree of Taurus, and his declination being then 15. degrees Northward, I find by the Aſtrolabe, Quadrant or Croſſe-ſtaffe, the Altitude of the Sunne in the forenoone to be 30. degrees. Wherefore I haue layd the Finitor to my Latitude, which is 52. and ſtayed it there. I marke in what point the Almicanterath cutteth the Sunnes foreſaid Parallel in the Mater, and I find that the houre-line of eight in the forenoone cutteth that point, which ſheweth that it was then eight of the clocke in the morning, and that the Sunne was about 15. degrees diſtant from the Eaſt towards the South.

How

PROPOSITION. X.

How to find the riſing and ſetting of the Sunne euery day in euery Latitude, and thereby the length of the day, and in what Coaſt or part of the Horizon he riſeth and ſetteth.

Bring the Finitor to your Latitude, and ſtaying it there, looke in the Mater where the Parallel of the Sunne doth cut the Finitor, and the houre-line which croſſeth that point, will ſhew the houre of his riſing and ſetting, and the number of houres betwixt his riſing and ſetting is the length of the day, and the number of the Azimuthes betwixt that point of the Finitor, and the Centre or firſt Azimuth, will ſhew you in what part or Coaſt of the Horizon hee doth riſeth and ſetteth. As for Example, ſeeking by this Rule to know at what houre the Sunne riſeth the 19. of Iune 1592. he being then in the ſixth degree 39. minutes of Cancer, and his declination then 23. degrees 1'9. I finde that hee riſeth 12. minutes before foure, and goeth downe 12. minutes after 8. and thereby I find the length of the day, counting from Sunne riſe to Sunne ſet, to bee 16. houres and 24. minutes, and that hee riſeth from the Eaſt towards North 40. degrees, which according to the Mariners reckoning is Northeaſt and by Eaſt, two quarters and ſomewhat more towards the North.

PROPOSITION. XI.

How to know euery day at what houre the Moone riſeth and ſetteth, and how long ſhe continueth aboue the Horizon, and alſo when ſhe is full South.

First you muſt learne by ſome Almanack or Ephemerides, in what ſigne and degree the Moone is, & whether it be a Northerne ſigne or Southerne ſigne, for if ſhe be in a Northern ſigne, then bring her place to yͤ Horizon of your latitude in the Northeaſt part of the Aſtrolabe,

but if ſhe be in a Southerne ſigne, bring her place to the ſayd Horizon in the Southeaſt part of the Aſtrolabe, and there hauing ſtayed the Rete, bring the Labell to the place of the Sunne for that day, and the Labell will point to the houre of the Moons riſing in the limbe of the Mater: but becauſe the Almanacke or Ephemerides doe not ſet downe the true place of the Moone but onely at noone, you muſt therefore conſider whether it be in the forenoone or in the afternoone that you ſeeke, for if it be in the afternoone, you had neede to know how many houres are runne from noone, & then for euery houre, to adde halfe a degree to the place of the Moone which you found at noonetide, but if it be in the forenoone, then you muſt ſubtract from her place at noone, for euery houre halfe a degree, ſo ſhal you go very nigh to find her true place in the Zodiaque for that houre, though you know not her Latitude, which is but 5. degrees at the moſt, and therefore can cauſe no great errour in this matter. Now to know when ſhe ſetteth, you muſt doe thus: if the Moone be in any Northerne ſigne, then you muſt bring her place to the foreſaid Horizon in the Northweſt part of the Aſtrolabe, and by laying the Labell to the place of the Sunne, it wil point to the houre of her ſetting, but if ſhe be in any Southerne ſigne, you muſt bring her place to the Horizon in the Southweſt part of the Aſtrolabe, and the Labell being laid to the place of the Sunne will point to the houre of her ſetting. Now if you would know how long time ſhe is aboue the Horizon, and alſo at what houre ſhe is full South, then count the houres betwixt the riſing and ſetting, and that ſhall be the time of her continuance aboue the Horizon, and the very middeſt of that is the true houre that ſhe is full South. As for example, the fourth day of September 1592. in the Latitude 52. at nine of the clocke at night, the Sunne being in the 21. degrees 4'7. of Virgo or there abouts, and the Moone being in the 2. degree 3'0. of Capricorne, I am deſirous to know when the Moone did riſe that day, and by working according to the rule before ſet downe, I find that ſhe did riſe about three of the clocke in the afternoone, and that ſhe went downe at ten of the clocke at night and halfe an houre paſt, and that ſhe was full South, or at the Meridian a little before ſeuen of the clocke in the afternoone. And as by this rule you may finde out the time of the riſing and ſetting of the Moone, ſo may you finde the time of the riſing and ſetting of the other fiue Planets, that is, Saturne, Iupiter, Mars, Venus, and Mercurie, any day throughout the yeare, ſo as you know their places in the Zodiaque, which the Ephemerides of Stadius doth ſhew, not onely at noonetide, but alſo at any other houre of the day by helpe of certaine Tables made of purpoſe, the vſe of which Tables I haue ſet downe in the latter end of my Treatiſe of the two Globes.

PROPOSITION. XII.

How to finde out the right aſcenſion of the Sunne, or of any degree or portion of the Ecliptique.

TAke the Rete and the Labell cleane from the Aſtrolabe, & ſeeke out in the Ecliptique line of the Mater, the ſigne and degree whoſe right aſcenſion you would know, and marke what Meridian cutteth that point: that done, place the Labell vpon the pinne which ſtandeth in the very Centre of the Iewell, and make the fiduciall line thereof to lie right vpon and alongſt the Equinoctiall line, either towards your right hand, or towards your left, according as the ſigne & degree whoſe aſcenſion you ſeeke is placed in the Mater. Then marke where the foreſaid Meridian cutteth through the Label, & alſo through the Equinoctiall line, and the number of degrees contained in the Labell, betwixt the Centre & that point of the Equinoctiall, is the right aſcenſion of that degree of the Ecliptique which you ſeeke, which number of degrees you muſt count vpon the Labell in this manner. For if that ſigne & degree be contained betwixt the firſt point of Aries & the firſt point of Cancer, then you muſt begin to count vpon the Labell at the Centre, & ſo proceed forward towards Cancer, the right aſcenſion of whoſe firſt point is 90. degrees, but if the ſigne & degree which you ſeeke, be betwixt the beginning of Cancer, and the beginning of Libra, which is at the very Centre right againſt Aries, then you muſt count vpon the

Label backward, frõ 90. to 180. by adding to euery 10. ſpace of the Labell 10. degrees, ſo as the firſt number proceeding towards your left hand ſhall be 100. and next to that 110. and ſo forth vntill you come to 180. which is the right aſcenſion of the firſt point of Libra: and from Libra you muſt count toward Capricorn 190. then 200. and ſo forth vntil you come to 270. which is the right aſcenſion of the firſt point of Capricorne: and from thence you muſt count 280. 290. then 300. and ſo forth towards the centre vntil you come to 360. which is the right aſcenſion of the laſt point of Piſces, ſo as though there be ſet downe in the labell but 90. degrees both forward and backward, yet 90. being foure times repeated, doe make in all 360. which is the whole longitude of the Equinoctial. As for example, you would know perhaps the right aſcenſion of the 10. degree of Sagittarius, here by ſeeking in the Mater, you ſhall find that the Meridian paſſing through that degree; wil cut both the Labell being laid towards your left hand, and alſo the Equinoctiall in the 248. degree 21. minutes, which is the right aſcenſion of the tenth degree of Sagittarius, in counting whereof remember to begin from 180. that is from the centre, and this aſcenſion agreeth with the Table of right aſcenſions ſet downe in Stadius his Ephimerides the 44. page of his Booke. Againe in ſeeking to know the right aſcenſion of the 10. degree of Taurus, if you begin to count vpon the Labell from the centre, which is the firſt point of Aries, you ſhall finde that Meridian which paſſeth through the 10. degree of Taurus, wil cut the Labell, & the Equinoctial line in the 37. degree 3'5.

PROPOSITION. XIII.

Another more readie way to find out the right aſcenſion of any degree or portion of the Ecliptique by the Rete.

LAy the Finitor euen with the Axeltree, ſignifying heere the right Horizon, ſo as the firſt point of Aries may meete with the Eaſt point of the ſayd Horizon, and lay the Labell right vpon and alongſt the Equinoctiall Line, eyther towardes Cancer, or towardes Capricorne, according

according as the ſigne and degrée which you ſéeke is placed in the Ecliptique of the Mater, and marke therewith what Meridian paſſeth through that degrée, and follow the ſame vntill it cutteth the Equinoctiall, and alſo the Labell lying thereon: and by counting vpon the Labell the number of degrées to that point in ſuch order as is before taught, you ſhall haue your deſire. As for example, if you ſéeke to know the right aſcenſion of the tenth degrée of Leo, héere hauing placed the Finitor, as before is taught, ſéeke out in the Mater what Meridian paſſing through that degrée cutteth the ſaid Equinoctiall, and in what point, and lay the Labell to the ſaid Equinoctiall, according as the Signe requireth, be it towards Cancer or Capricorne, and by counting the degrée vpon the Labell as is before taught, that is, from 90. procéeding from the limbe backward towards the Centre, you ſhall finde the right aſcenſion of the 10. degrée of Leo to bée 132. degrées, which differeth from the foreſaid Table but 2'7. a thing of ſmall moment, conſidering the narrow ſpaces of the Meridians in the Mater.

PROPOSITION. XIIII.

How to find out the aſcenſionall difference of the Sunne, or of any degree or point of the Ecliptique.

BRing the Finitor to your Latitude, and there ſtaying it, looke amongſt the Meridians in the Mater in what point the Parallel of the Sunne cutteth the Finitor, and the number of the Meridians contayned betwixt the Axeltrée, and that point, ſhall be the aſcenſionall difference. As for Example, in the Latitude 52. I would know the aſcenſionall difference of the Sun being in the fourth degrée of Cancer, at which time his Parallel of declination is 23. degrées Northward: héere by working according to the Rule I finde the aſcenſionall difference to be 33. degrées 3'0.

PROPOSITION. XV.

How to find out the oblique aſcenſion of the Sunne, or of any point of the Ecliptike.

HAuing found the right aſcenſion, and alſo the aſcenſional difference by the former Propoſitions, conſider whether the declination of the Sunne, or of any other point of the Ecliptike be North or South; for if it be North, then ſubtract the aſcenſional difference out of the right aſcenſion, and the remainder ſhall be the oblique aſcenſion. But if the declination be South, then adde the aſcenſionall difference to the right aſcenſion, and the ſumme thereof ſhal be the oblique aſcenſion. As in the former example, knowing the declination of the Sunne to be 23. degrées Northward, I ſubtract the aſcenſionall difference which was 33. degrées, 30. minutes, out of the right aſcenſion of the Sunne, which was 94. degrées, and there remaineth 60. degrées, 3'0. which is the oblique aſcenſion of the Sunne being in the fourth degrée of Cancer, and his declination being 23. degrées Northward, as is before ſuppoſed.

PROPOSITION. XVI.

How to find out the right aſcenſion of any Arke or portion of the Eclipticke, and therewith to know what time it ſpendeth in riſing in a right Spheare.

BRing the end of the giuen Arke found out in the Zodiaque of the Rete, vnto the left ende of the Equinoctiall marked with D. and there ſtaying it, lay the Fiduciall line of the labell vpon the beginning of the ſaid Arke, and the number of degrées in the innermoſt limbe of the Mater, contained betwixt the left end of the Equinoctiall and the Fiduciall line of the labell, ſhall bee the right aſcenſion of that Arke, and the houre ſet downe in the outtermoſt limbe whereunto the labell pointeth, ſhall be the time which the ſaid Arke ſpendeth in his riſing, ſo ſhall you find the Arke of the whole ſigne Taurus, to be 30. degrées, and to ſpend in his riſing two houres.

PROPOSITION. XVII.

How to find out the oblique aſcenſion if any Arke of the Ecliptike in any Latitude, & what time it ſpendeth in his riſing.

FInd the oblique aſcenſion both of the beginning & ending of the Arke by yͤ 15. Propoſitiō, then ſubtract the ſayd aſcenſion of the beginning of the Arke, out of the aſcenſion of the ending of the ſaid Arke, alwaies remembring that if the oblique aſcenſion of the beginning be greater then the other, then to adde to the leſſer 360. and out of that ſumme make your ſubtraction, for the remainder ſhall be the oblique aſcenſion of the whole Arke, then count the number of that aſcenſion in the innermoſt limbe of the Mater, beginning at the left end of the Equinoctiall marked with D. and ſo procéede vpward towards your right hand, and where the ſaid aſcention endeth, there lay the labell, and the houre whereunto the label pointeth, ſheweth the time which the ſaid Arke ſpendeth in his riſing in that Latitude. As for example, I would know the oblique aſcenſion of the whole Arke of the ſigne of Taurus, and what time that Arke ſpendeth in his riſing: firſt, here hauing found the oblique aſcenſion of the firſt point of Taurus, to bee about 13. degrées, in this Latitude 52. and the oblique aſcenſion of the laſt point of that ſigne to be about 30. héere by taking 13. out of 30. there remaineth 17. degrées, which is the oblique aſcenſion of the whole Arke of the ſigne Taurus, which 17. degrées, I count in the limbe of the Mater, from the end of the Equinoctial marked with D. vpward, and there laying the labell. I find that it pointeth to one houre and two degrées, which maketh 8'. ſo as I conclude thereby, that the whole Arke of the ſigne Taurus, ſpendeth in his oblique aſcenſion one houre and eight minutes.

PROPOSITION. XVIII.

How to find out the oblique diſcenſion of any point of the Ecliptique in any Latitude.

HAuing found out the oblique aſcenſion of the point oppoſite to the point giuen, adde thereunto 180. degrées, and the ſumme thereof ſhall be the oblique diſcenſion of the point giuen, alwaies remembring if the ſumme of addition doe excéede 360. to ſubtract out of that ſumme 360. and the remainder ſhall be the deſcenſion of the point giuen. As for example, you would know the oblique deſcenſion of the firſt point of Taurus, whoſe point oppoſite is the firſt point of Scorpio, and his oblique aſcenſion according to Reynholdus his Tables is 222. degrees, 36. minutes, whereunto if you adde 180. you ſhall make the totall ſumme to bee 402. degrées, 36. minutes, from which ſumme if you ſubtract 360. degrées, according to the rule before giuen, there will remaine 42. degrées 36. minutes, which is the oblique deſcenſion of the firſt point of Taurus.

PROPOSITION. XIX.

How to find out the oblique diſcenſion of any Arke giuen of the Ecliptike, and therewith to know the time which it ſpendeth in his ſetting.

HAuing found the oblique diſcenſion of the beginning, and alſo of the ending of the giuen Arke by the laſt Propoſition, ſubtract diſcenſion of the beginning out of the diſcenſion of the ending, and the remainder ſhalbe the oblique diſcenſion of the giuen Arke, alwaies remembring if the ſubtraction cannot bee made to adde thereunto 360. that done, diuide that by 15. and the quotient will ſhew the number of houres, which the giuen Arke ſpendeth in his ſetting: and remember that if in making that diuiſion, there be any remainder left, to multiply that remainder by foure, and ſo you ſhall haue the minutes. By working, thus you ſhall find the oblique diſcenſion of the whole Arke of Gemini, to be 36. degrees, 49. minutes, & in the Latitude 52. to ſpend in his going downe two houres and 24. minutes.

PROPOSITION. XX.

How to know the height of any ſtarre at any houre, without ſeeing the ſtarre, and thereby to find out in the firmament all the ſtarres that be diſcribed in the net, and are to be ſeene with the eye.

LAy the Labell to the houre ſuppoſed vpon the limbe of the Mater, and then bring the place of the Sunne for that day to the Fiduciall line of the labell, and there hauing ſtayed the Rete, bring the Fiduciall line of the labell to the tippe of the ſtar, whoſe altitude you ſéeke, and the labell will ſhew you vpon the limbe of the Mater, how many degrées that ſtarre is diſtant from the South. Againe, by counting vpon the labell, the degrées continued betwixt the point of the labell, and the tip of the ſame ſtarre, you ſhall haue his declination, which is North or South, according as the ſtarre is Northerne or Southerne. Then bearing in minde, as well the ſtarres diſtance from the South, as alſo his declination, worke thus. Bring the Finitor to your Latitude, and vpon the ſtarres Parallel or Circle of declination in the Mater, Count from the limbe of the Mater, the diſtance of the ſtarre before found, and marke what Almicanterath croſſeth that point, for there is the altitude of the ſtarre at that inſtant, and the Azimuth which cutteth that point, ſheweth in what part or coaſt of heauen the ſtar is at that preſent. And remember to ſéeke the Parallel of the ſtarre on that ſide of the Mater, either on your right or left hand, ſo as it may fall amongſt the Almicanteraths, for otherwiſe you ſhall not find that you ſéeke. As for example, the 26. of October 1591. at nine of the clocke at night, you would know the height of the firſt ſtarre of the Rames horne, called Cornu Arietis, the Sunne being then in the 12. degrées and 12. minutes of Scorpio. Héere after that you haue laide the labell to the houre ſuppoſed, and brought the degrée of the Sunne for that day to the Fiduciall line of the Labell, and ſtayed the Rete there, bring the Labell to the tippe in the ſtarre in the Rete, and the Labell will ſhew in the limbe of the Mater, how many degrées the ſtarre is diſtant from the South, which you ſhal find to be 28. degrées, and 30. minutes, and the declination of the ſayd ſtarre being counted vpon the ſaid Labell, to be 18. degrées, then kéeping thoſe two numbes in minde, bring the Finitor to your Latitude, ſuppoſing the ſame to be 52. degrées, and there ſtaying the Rete, ſéeke for the Parallel of the ſtarre, which is 18. degrées on your right hand, and vpon that Parallel count by the Meridians from the limbe inward, the ſtarres diſtance from the South, which is 28. degrées 30. minutes, and you ſhall find that the 49. Almicanterath cutteth that point, ſo as you may conclude, that the Altitude of the ſtarre called Cornu Arietis, was at that houre 49. degrées, and that the 47. Azimuth, doth alſo paſſe through that point, which ſheweth that the ſtarre is 47. degrées from the Eaſt towards the South, which according to the Marriners account is Southeaſt, and ſomewhat more to the Southward. Now to finde out the ſayd ſtarre in the firmament, if it bée ſtarre light, you haue no more to do but to lay the Diopter of the Aſtrolabe at that altitude, and to turne your face towards that coaſt (that is to ſay) Southeaſt and ſomewhat more to the Southwars, and the next bright ſtarre which anſwereth in that coaſt to that altitude, is the ſtarre which you ſéeke.

PROPOSITION. XXI.

How to find out the aſcenſionall difference of any ſtarre.

BRing the Finitor to your Latitude, and ſtaying it there, looke in what point the Parallel of the ſtarres declination cutteth the Finitor, and the number of the meridians contained betwixt that point and the Centre, is the aſcenſionall difference, ſo ſhall you find the aſcenſionall difference of the Buls eye called Oculus Tauri, whoſe declination is 15. degrées, 4'8. to be 21. degrées.

PROPOSITION. XXII.

How to know the oblique aſcenſion of any ſtarre.

IF the declination of the ſtarre bée Northerne, ſubtract the aſcenſionall difference out of the right aſcenſion, and the remainder ſhall be the oblike aſcenſion of the ſtarre, but if his declination be Southerne, you muſt adde the aſcenſionall difference to the right aſcenſion, and that ſhall be the oblique aſcenſion of the ſtarre. As for example, becauſe Oculus Tauri is a North ſtarre, ſubtract his aſcenſionall difference, which is 21. degrées, out of his right aſcenſion, which as the aforeſaid Table ſheweth, is 62. degrées, 3'0. and there will remaine 41. degrées, 3'0. which is the oblique aſcenſion of the ſaid ſtarre. But if it were a South ſtarre, as Spica Virginis, whoſe declination is almoſt 9. degrées Southward, and her aſcenſionall difference is 11. degrées 3'0. then you muſt adde the aſcenſionall difference to her right aſcenſion, which is 195. degrées 5'1. ſo ſhall you find her oblique aſcenſion to bée 207. degrées 2'1.

PROPOSITION. XXIII.

How to know what ſtarres doe neuer riſe nor ſet in any Latitude.

IF the ſtarre be a North ſtarre, hauing a greater declination, be it neuer ſo little, then is the Altitude of the Equinoctiall anſwerable to your Latitude: As for example, ſuppoſe your Latitude to be 52. which if you take out of 90. then the remainder is 38. degrées, which is the Altitude of the Equinoctiall, anſwerable to that Latitude, otherwiſe called the complement, then that ſtarre neuer ſetteth in that Latitude. Againe, if it bée a South ſtarre, hauing greater declination neuer ſo little then the cõplement of your Latitude, then that ſtar neuer riſeth aboue your Horizon. As for example, in the Latitude 52: the ſtarre called Hircus, that is the Goate, being a North ſtarre, neuer ſetteth in that Latitude, becauſe his North declination is 45. degrées, which is greater then the complement of your Latitude by 7: degrées. Alſo the ſtar called Lyra, whoſe declination is 38. degrées, like vnto the complement of your Latitude, doth neuer ſet, but only toucheth your Horizon aſwel at his riſing as ſetting: ſo contrariwiſe the ſtarre called Canopus, being a South ſtarre hauing 51. degrées 3'1. of South declination, neuer riſeth aboue your Horizon in the foreſaid latitude 52. And by this rule you may iudge in like manner of all the reſt of the fixed ſtarres both North and South.

PROPOSITION XXIIII.

How to know at what houre of the day or night any ſtarre riſeth or ſetteth.

FIrſt, marke by the outward or inward ſhooting of the longeſt tippe of the Starre, whether it bée North or South: for if it be North, then count amongſt the Meridians in the Mater ſo many Meridians as your

Latitude amounteth to, beginning at the Axe-trée, and ſo procéeding towards the Northeaſt, which is betwixt the North pole and the Equinoctial on your left hand, but if the ſtar be South, then count your Latitude procéeding from the ſayd Axle-trée towards the Southeaſt, which is betwixt the ringle and the North pole on the right hand, and bring the tippe of the ſtarre to that Meridian, which now ſignifieth your Horizon, and there ſtaying the Rete, bring the labell to the place or degrée of the Sunne in the Zodiaque of the Rete, in which the Sunne is that day you ſéeke, and the houre in the limbe whereto the Labell pointeth, is the houre at which the ſtarre riſeth that day or night. Now to know when the ſame ſtarre ſetteth, you haue no more to doe but to worke with the ſtarre in the Northweſt part, in ſuch order as you obſerued before in the Northeaſt part of the Aſtrolabe: As for example, I would know at what houre the Buls-eye called Oculus Tauri, doth riſe the laſt day of June, the Sunne being then in the 17. degrée and 40. minutes of Cancer. Here becauſe this ſtarre is a North ſtarre, I bring the longeſt tippe thereof to the 52. Meridian, which is our Latitude, counting from the Axe-trée towards the Northeaſt part of the Aſtrolabe, which is on my left hand, for that Meridian is alwaies the Horizon, ſeruing the Latitude 52. and there ſtaying the Rete, I bring the Fiduciall line of the Labell to the place of the Sunne, which at that day is the 17. degrées 4'0. of Cancer, as I ſaid before; and I find that the Labell pointeth to one of the Clocke 3'0. after midnight: wherefore I conclude that Oculus Tauri riſeth that day at that preſent houre. Now to know at what houre that ſtarre goeth downe, the ſame day I bring his longeſt tippe to the ſaid Horizon towards the Northweſt, and ſtaying the Rete there, I lay the label to the 17. degrées 4'0. of Cancer, as before, ſo that the Labell pointeth to foure houres and 20. minutes in the afternoone, at which time he goeth downe, ſo as he continueth at that time aboue the Horizon in the Latitude 52. 14. houres, 48. minutes. And to know the abode of any ſtarre aboue the Horizon, the next Propoſition doth alſo ſhew.

How

PROPOSITION. XXV.

How to know how long any ſtarre continueth aboue the Horizon in euery Latitude.

Bring the Finitor to your Latitude, and looke in what point the Parallel or declination of the ſtar cutteth the Finitor, and the number of the Meridians in the Mater, contained betwixt the limbe and that point, doe ſhew the halfe time of his abode aboue the Horizon; which being doubled, is the whole time of his abode aboue the Horizon. And in numbring the ſaid Meridians, whereof 15. doe make an houre, remember to begin to count from the right ſide of the Mater, procéeding towards your left hand, and remember alſo that the middle Meridian or Axle-trée, ſignifieth alwaies the ſixth houre, ſo ſhall you not erre in your account. As for example, hauing brought the Finitor to the Latitude 52. looke in what point the Parallel of the foreſaid ſtarre Oculus Tauri, cutteth the Finitor, and by numbring the Meridians procéeding from the limbe on your right hand towards the left, you ſhall find the Parallel of Oculus Tauri, being 15. degrées, 4'9. to cut the 111. Meridian, which being doubled, and then the ſumme thereof diuided by 15. maketh 14 houres and 4'8. as before.

PROPOSITION. XXVI.

How to find out the Starres houre, and thereby to know the houre of the night.

First, hauing taken the ſtarres altitude, ſet the Finitor to your Latitude, and looke at what houre-line in the Mater that Stars Almicanterath, and the Parallel of his declination doe méet, and hauing ſought out the ſame houre in the limbe right againſt that point

bring

bring the labell thereunto, for that is the ſtarres houre, and there ſtaying with your fingers end the very point of the labell, bring the longeſt tippe of the ſtarre to the Fiduciall line of the labell, and ſtaying there the Rete, turne the labell to the degrée of the Zodiaque of the ſaid Rete, wherein the Sunne is that day, and the labell will point to the true houre of the night ſet downe in the outward limbe of the Mater. As for example, I ſuppoſe that the ſeuenth of October 1591. the Sunne being then in the 23. degrée 1′5. of Libra, I tooke the altitude of the ſtarre Hircus, that is the Goate, which I found to be 20. degrées, here hauing ſet the Finitor to my Latitude 52. I looke in the Mater at what houre-line that Almicanterath, and the Paralel of the ſame ſtar, which is 45. degrées Northward, doe meet or croſſe one another, and I find that they meet iuſt vpon the fourth houre-line of the fore-noone, wherefore I ſéeke right againſt that point the ſame houre in the outermoſt limbe of the Mater, for that is the ſtars houre, and hauing placed the labell at that houre, I ſtay it there with my finger, vntill I haue brought the longeſt tippe of the Starre Hircus vnto the Fiduciall line of the Labell, & there ſtaying the Rete, I turne the label to the degrée of the Sunne, which is 23. degrées 1′5. of Libra, and I ſee that the labell pointeth to the ſeuenth houre of the night ſet down in the limbe of the Mater and halfe an houre paſt. Maſter Blagraue ſaith, that the ſooner you take the Altitude of the ſtarre whereby you ſéeke to know the houre of the night, you ſhall haue the houre more truly.

Proposition. XXVII.

How to find out the diſtance betwixt any two ſtars contained in the Net.

First, conſider whether the declination of both ſtarres be either South or North, or that the one be South and the other North, for if both their declinations be South or North, then you muſt not leaue to turn the Rete to and fro vntill you haue brought the

long,

longeſt tips of both ſtarres, to one ſelfe Meridian in the Mater, that done, count vpon the ſaid Meridian how many degrées are contayned betwixt the tips of the ſaid ſtarres, for that is the diſtance betwixt them. But if the one ſtarre haue North declination and the other South, then turne the Rete to and fro, vntill both ſtarres doe lye vpon two ſuch ſeuerall Meridians, as each of them is equally diſtant on each hand from the Axeltrée, then count how many degrées or Meridians are contayned betwixt the Axeltrée and either of thoſe ſtarres (which you wil) and that is their diſtance, ſo ſhall you finde the diſtance betwixt Oculus Tauri, and Canis minor, being both North ſtarres, to be 46. degrées 2′0. and the diſtance betwixt Oculus Tauri, and Canis maior, whereof the firſt is a North ſtarre, and the other a South ſtarre, to be iuſt 46. degrées.

Proposition. XXVIII.

Another way to know the diſtance of any two ſtarres, their Longitudes and Latitudes being firſt knowne, and alſo by that meanes to finde out the diſtance betwixt any two places vpon the Earth.

First, ſéeke to know the difference of their Longitudes by ſubtracting the leſſer Longitude out of the greater, then count that difference from the outermoſt Meridian of the Mater towards the Centre, and marke well that Meridian at which your account endeth, then number vpon the Limbe of the Mater from the Equinoctiall the greater Latitude, either Northward or Southward, according as the Latitude is, and to that point bring the Zenith of the Rete, then vpon the ſelfe-ſame Meridian before marked, count from the Equinoctiall the leſſer Latitude, and looke what Azimuth paſſeth through that point, for the degrées which are contayned betwixt that point and the Zenith ſhall be the diſtance: and thus doing you ſhall find the diſtance betwixt Oculus Tauri, and Canis

maior

maior to be 46. degrées and 1'5. and the diſtance betwixt London and Venice, to be 12. degrées and 20. which 12. degrées being multiplyed by 60. maketh 720. miles, whereto if you adde for the 20. minutes 20. miles, it will make in all 740. miles.

PROPOSITION. XXIX.

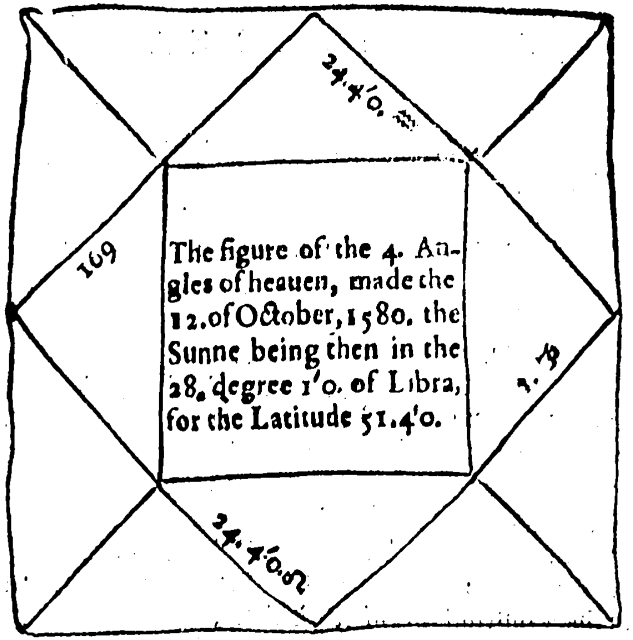
How to find the degree of Medium Cœli, *at any houre of the day (that is to ſay) the degree of the Zodiaque, that is in the Meridian at any houre that you ſeeke, and alſo the degree called* Imum Cœli.

FIrſt, ſéeke out the place of the Sunne for that day in the Zodiaque of the Rete, and hauing laid the labell to the houre ſuppoſed vpon the limbe of the Mater, bring the place of the Sun to the Fiduciall line of the labell, and there ſtaying the Rete, looke what degrée of yͤ ſaid Zodiaque cutteth the the noone line or Meridian at noone tyde, which you ſhall eaſily find by laying the labell to the houre of 12. at noone, for the Fiduciall line of the labell croſſing the Zodiaque, will ſhew the degrée of mid-heauen at that houre. As for Example, the 26. of Iune, 1592. I would know the degrée of Medium Cœli, at eight of the clock in the morning, the Sun being that day in the 14. of Cancer. Here by laying the labell to the ſaid houre in the limbe of the Mater, I bring the place of the Sunne to the Fiduciall line of the labell, and there hauing ſtayd the Rete, I bring the labell to the twelfth houre at noone, and I find that the labell cutteth the Zodiaque of the Rete in the 18. of Taurus, which at that houre is the degrée of Medium Cœli, whoſe point oppoſite is the 18. degrée of Scorpio, & that is at that houre Imum Cœli, which the labell being layd to the twelfth houre of midnight will ſhew.

PROPOSITION. XXV.

How to find out the Horoſcope, or aſcendent at any time of the day or night, and thereby to haue the foure principall Angles of Heauen.

HAuing layd the labell to the houre giuen vpon the limbe of the Mater, ſtay it there with your finger, vntill you haue brought the place of the Sunne for that day vnto the fiduciall line of the labell, and there ſtaying the Rete, looke what degrée of the Zodiaque thereof toucheth or croſſeth the Horizon, anſwerable to your latitude, for that is the aſcendent at that preſent houre. As for example, I would know the aſcendent at eight of the Clocke at night the twelfth of October 1580. the Sun being then in the 28. degrée 1'4. of Libra. Here hauing layd the labell vpon the ſayd houre, I bring the 28. degrées, 10. minutes of Libra to the Fiduciall line of the Labell, and there ſtaying the Rete, I find by helpe of the Label that my Horizon which is the 51. Meridian, and 40. minutes, counting on both hands from the Axle-trée, that the firſt degrée of Cancer, doth croſſe my Horizon in the Northeaſt quarter, wherefore I affirme that to be the aſcendent or firſt houſe, whoſe point oppoſite being the firſt of Capricorne, is the deſcendent or ſeuenth houſe, then by bringing the Fiduciall line of the label, to the South end of the Equinoctiall, at which the ringle hangeth, I find by helpe of the Labell that the 24. degrées 4'0. of Aquarius, cutteth the Equinoctiall, which is the tenth houſe, or Culmen cœli, whoſe point oppoſite being the 24. degrées, 4'0. of Leo, is the fourth houſe, otherwiſe called Imum cœli, and thus you haue all the foure principall houſes of heauen for that houre, as you may ſée in this figure hére following.



The figure of the 4. Angles of heauen, made the 12. of October, 1580. the Sunne being then in the 28. degree 1'0. of Libra, for the Latitude 51.4'0.

But the difficultie of finding out the true aſcendent, conſiſteth in knowing whether it is to be ſought in the Northeaſt quarter, or in the Southeaſt quarter of the Iewell. The Northeaſt quarter is that which lyeth betwixt Imum cœli, and the North Pole or Eaſt end of the Axle-tree, becauſe in this caſe the Axle-tree ſignifieth the line of the Eaſt & Weſt, and the Equinoctiall ſignifieth the line of South and North, at the South end whereof is faſtned the ringle or handle. But in the former example, you may plainly ſee that the North part of the Zodiaque of the Rete, doth cut the Horizon, as wel in the Northeaſt quarter as in ẏ Southeaſt quarter with two ſeueral degrees & ſignes, for in the Northeaſt quarter, the Zodiaque cutteth the Horizon with the firſt of Cancer, which is the aſcendent, and in the Southeaſt quarter it cutteth the Horizon, with the eight of Taurus, which is not the aſcendent: for you haue to vnderſtand, that euery degree of the Zodiaque doth both riſe & ſet either towards the North or towards the South, the firſt point Aries and of Libra only excepted, both which doe riſe right Eaſt, and goe down right Weſt, euen as the Equinoctiall doth, whereof M. Blagraue doth gather a rule how to find out by his Iewel, when the aſcendent is to be ſought eyther in the Northeaſt quarter of the Mater, or in the Southeaſt quarter, which is thus: The aſcenſion of any of the ſix Northern ſignes is to be ſought for, in the Northeaſt part of the Iewell, & the aſcenſion of any of the ſix Southern ſignes is to be ſought for in the Southeaſt part of the Iewel. For although that the North part of the Zodiake of the Rete, contayning ẏ 6. Northern ſigns cutteth the Horizon anſwerable to your latitude, aſwell in the Northeaſt, as in the Southeaſt part of the Iewell, yet you muſt ſeeke the aſcendent in the Northeaſt part, & not in the Southeaſt part of the Iewel, becauſe that euery degree of any of ẏ ſix Northerne ſignes, riſeth Northernly: ſo contrariwiſe, if the South part of the Zodiaque contayning the ſix Southerne ſignes doe cut the Horizon, aſwell in the Northeaſt part, as in the Southeaſt part of the Iewell, yet you muſt ſeeke the aſcendent in the Southeaſt part, and not in the Northeaſt part of the Iewell. As for example, the ſecond day of Auguſt 1592. the Sunne being in the 20. of Leo, I would know the aſcendent at foure of the clock in the afternoone: heere hauing layd the labell to that houre, and brought the place of the Sunne to the Fiduciall Line thereof, I find that the 13. degrees 3'0. of Aquarius doth cut the Horizon ſeruing to your latitude 52. in the Northeaſt part of the Iewel, and that the 19. of Sagittarius cutteth the ſaid Horizon in the Southeaſt part of the Iewel, which muſt be the aſcendent, becauſe that euery degree of any of the Southerne ſignes riſeth Southernly, and not Northernly.

PROPOSITION. XXXI.

How to find the Circles of poſition, and to know how much the Pole is eleuated aboue euery ſuch Circle in any Latitude, without the knowledge whereof, you cannot finde out the twelue Houſes by this Aſtrolabe.

THe Zenith of the Rete, firſt bring to your Latitude, ſo ſhall the Azimuthes become circles of poſition, then vpon the Parallel of declination of the point giuen, according as the declination thereof is North or South: count from the limb on your right hand, ẏ number of the hours giuen

giuen amongſt the Meridians in yͤ Mater, & the Azimuth which the Meridian of that houre cutteth, ſhall be the circle of poſition, which had, you ſhall find the eleuation of the Pole aboue the circle of poſition thus: Count your latitude amongſt the Almicanteraths, from the Zenith vpon the Circle of poſition found, & to that point wheras your latitude endeth, bring the Fiduciall line of the label, & reckon vpon the label how many degrées are contayned betwixt the limbe of the Rete, & yͤ point, for the number of thoſe degrées is the eleuation of the pole, aboue the circle of poſition. As for example, vſed by M. Blagraue himſelf, the 12. of October 1580. the Sun being then in the 29. degrée 1'0. of Libra, & his South declination 11. degrées 1'0. I wold know at 8. of the clock at nigh in what circle of poſition the ſun at that time was. Here I bring the Zenith to the latitude of Reading, which is 51 deg. 4'0. then for 8. of the clock I count 8. houres amongſt the Meridians in the Mater, from the South part of the Iewel vpō yͤ parallel of the Sun, being then 11. deg. 3'0. & by attributing to euery houre 15. Meridians, I find that the Meridian wheras the 8. houre endeth doth croſſe the 28. & ½ Azimuth, counting the Azimuths from the Zenith line, and that is the Circle of poſition, wherein the Sun was then vnder the earth in Northeaſt quarter. Now to know how much the Pole is eleuated aboue that Circle of poſition, I do count from the Zenith the foreſayd Latitude 51. degres, 4'0. vpon the ſayd Circle of poſition, and to the point where that Latitude endeth, I bring the label, & counting theron from the limbe of the Rete, the degrées contained betwixt the ſaid limbe, and the foreſaid point, I find the number of them to be 43. degrées 3'0. wherefore I conclude that the Pole is eleuated aboue the ſaid Circle of poſition, 43. degrées 3'0.

PROPOSITION. XXXII.

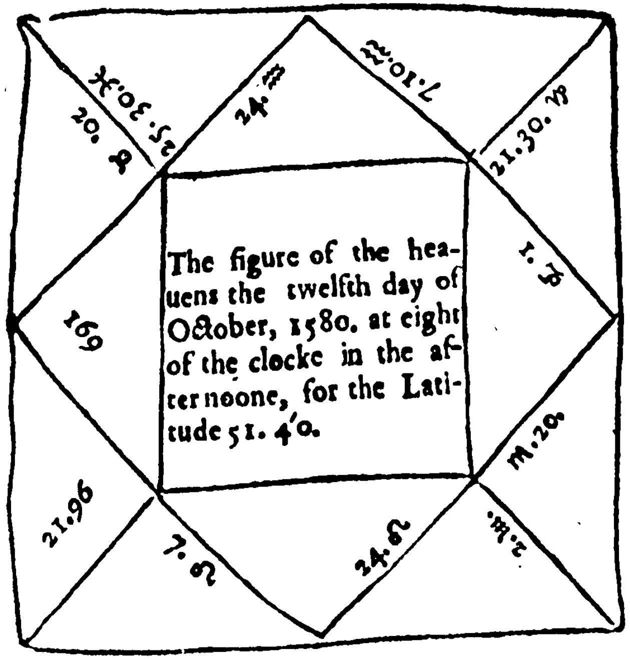
How to find out all the twelue Houſes of Heauen, and thereby to erect a figure at any houre of the day or night.

YOu ſhal vnderſtand yͤ order of this better, by this one example giuen by M. Blagraue himſelf, thē by manifold rules, wc be alſo ſo plainly expreſſed & obſerued in this example, as you néed none other inſtruction

to erect the like figure in any latitude, & at any houre of the day or night. Suppoſe then that you would erect a figure for one that was borne the twelfth of October 1580. at eight of yͤ clocke at night in the latitude 51.4'0. the Sun being then in the 28. degrée 1'0. of Libra, and his declination being at that time 11. degrées 1'0. Southward. Héere, firſt ſet downe in your figure already drawne, the foure Angles before found by the 30. Propoſition, anſwerable to the ſaid day and houre, then to find out the reſt of the houſes, doe thus, bring the Zenith of the Rete, to the Latitude preſuppoſed, which is 51. degrées 4'0. and ſtaying it there, marke what number of Azimuths or Circles of poſition doth cut euery 30. degrées of the Equinoctial counting yͤ degrées of the Equinoctiall, by helpe of the Meridians from the limbe towards the Centre, but you muſt count the number of the Azimuths or circles of Poſition, frō the Zenith line towards the limbe, of which Circles of poſition there be no more but ſixe at the moſt (that is to ſay) thrée betwixt the limbe & the Centre on the one ſide, and as many on the other ſide of the Centre, the eleuation or rather depreſſion of euery one, whereof you muſt ſéeke to knowe by the laſt propoſition. But M. Blagraue ſaith that you néed to know the eleuation or rather depreſſion, but only of two Circles of poſition, that is, of that which ſheweth the eleuenth & third houſe, & of that which ſheweth the twelfth & ſecond houſe, and ſo ſaith Stadius alſo, in the beginning of his Ephemerides, treating of the 12. houſes, for hauing them, you haue all the reſt. The order of working, according to M. Blagraue his rule is thus: hauing brought the Zenith to the forſaide Latitude, lóoke what Circle of poſition cutteth the Equinoctiall in the firſt 30. degrées next to the limbe, and you ſhall find that the 47. Azimuth or Circle of poſition (counting from the Zenith line) cutteth that point of the Equinoctiall, and therewith ſerueth to the eleuenth houſe, and alſo to the third houſe, and the eleuation of this Circle is 32. degrées, then from thence tell vpon the Equinoctiall 30. degrées more, which doe make in all 60. degrées, and through that point you ſhal find the 19. Azimuth or circle of poſition to paſſe, whoſe eleuation is 47. degrées and, this circle ſerueth to the 12. houſe and to the ſecond houſe. Now kéeping wel in mind thoſe two laſt elevations, that is 47. & 32. worke thus: Lay your label to the 8. houre of yͤ morning, which is 30. degrées, diſtant from the right Horizon or Axle-trée, and bring to the Fiduciall line thereof, the Culmen cœli or 10. houſe firſt ſet downe in your figure which is the 24. of Aquarius, and ſtaying it there, looke what degrée of the Ecliptique cutteth the 32. Horizon, which ſerveth to the 11. houſe counting from the right Horizon towards your left hand. And by following that Horizon up towards the North pole, you ſhall find yͭ the 25. degrées 3′0. of Piſces cutteth the ſame Horizon verie nigh unto the Pole, but by my inſtrument I find it to be the 27. degrées of Piſces, which perhaps is not truly made, & therefore ſet downe in the 11. houſe of your figure 25. degrées 3′0. of Piſces. Then bring the foreſaid Culmen cœli together with the label to the tenth houre of the morning, which is 30. degeées further towards the South, and ſtaying it there, looke what degrées of the Ecliptique cutteth the 47. Horizon, ſerving to the 12. houſe and you ſhall find that the 20. degrées of Taurus cutteth that Horizon, wherefore ſet downe the 20. of Taurus in the 12. houſe of your figure, then bring the Culmen cœli together with the labell to the 12. houre at noone; and you ſhall ſée the aſcendent which is the firſt of Cancer, to cut the oblique Horizon which is 51. degrées 4′0. and from thence bring the labell and Culmen cœli to two of the clocke in the afternoone, and ſtaying it there, you ſhall ſée the 21. degrée of Cancer to cut the 47. Horizon, which ſheweth the 2. houſe and alſo twelfth houſe as before, wherefore ſet down the 21. of Cancer in the ſecond houſe of your figure, that done remove the labell together with Culmen cœli to foure of the clocke in the afternoone, and there ſtaying it, you ſhall ſée the ſeventh of Leo to cut the 32. Horizon, which ſheweth both the third houſe and the eleventh houſe, as before: wherefore ſet the ſeventh of Leo in the third houſe of your figure, ſo have you eight of the houſes that is to ſay, the firſt, the ſecond, the third, the fourth, the ſeventh, the tenth, called Culmen cœli, the eleventh & the twelfth, ſo as there want only foure, that is, the fifth, the ſixth, the eight and the ninth houſe. The fifth is oppoſite to the eleventh, the ſixth to the twelfth, the eight to the ſecond, & the ninth to the third whoſe oppoſite ſignes each one having like number of degrées, are

are to be placed in the foure houſes of your figure that be wanting. As in the fifth houſe the 25. degrées, 3′0. of Virgo, in the ſixth houſe, the 20. degrées of Scorpio in yͤ eight houſe, the 12. degrée 3′0. of Capricorne, and in the ninth houſe the 7. degrée 1′0. of Aquarius, ſo have you all the twelve houſes. And by this meanes M. Blagrave ſaith, that you may make the places of the 12. houſes to ſerve for ever in any Latitude, ſo as you doe diſtinguiſh from the reſt with ſome colour thoſe two Horizons, whereof the one doth ſhew the eleventh and the third houſe, and the other Horizon ſheweth the twelfth and ſecond houſe, yea, and by this meanes you may (as he ſaith) make as true Tables to find out the twelve houſes in every Latitude, as thoſe that be calculated of purpoſe.

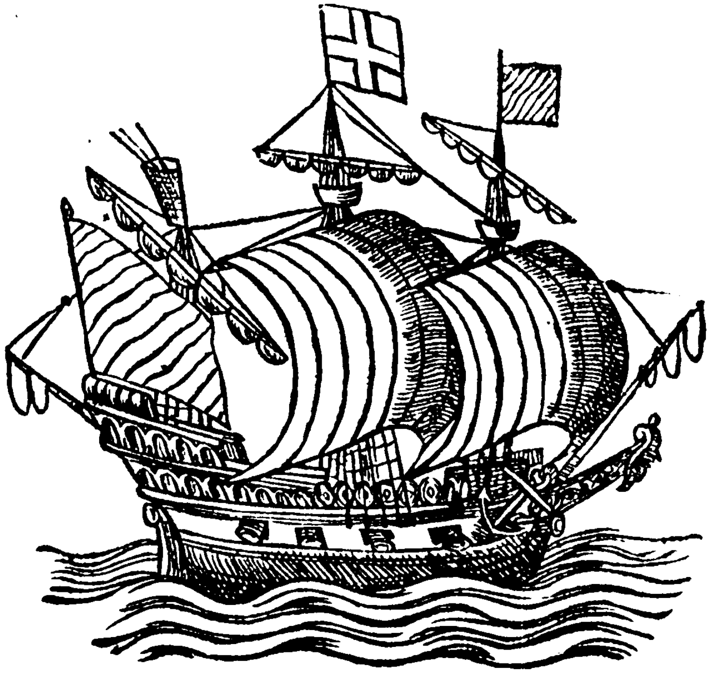
The figure of the foreſaid Twelve houſes.



The figure of the heavens the twelfth day of October, 1580. at eight of the clocke in the afternoone, for the Latitude 51. 4′0.

A NEVV AND NECESSARIE TREATISE OF NAVIGATION, containing all the *chiefeſt principles of that* ARTE.

Lately collected out of the beſt Moderne Writers thereof, by M. *Blundevile*,
and by him reduced into ſuch a plaine and
orderly forme of teaching, as euery man
of a meane capacity may eaſily vnderſtand the ſame.



They that goe downe to the Sea in ſhips, and occupy their buſines in great waters: Theſe men ſee the workes of the Lord, and his wonders in the deepe. *Pſalm.* 107.

Printed by WILLIAM STANSBY.

OF NAVIGATION, WHAT IT IS, AND WITH WHAT ORDER THE principles thereof are heere taught by Master BLVNDEVILL, *according to the rules of the beſt moderne writers of that* ARTE.

NAVIGATION, is an Art which teacheth by true and infallible rules, how to gouerne and direct a Ship from one Port to another, ſafely, rightly, and in ſhorteſt time: I ſay héere ſafely ſo farre as it lyeth in mans power to performe. And in ſaying rightly, I meane not by a right line, but by the ſhorteſt and moſt commodious way that may be found: and by ſaying in ſhorteſt time, I meane thereby according as the Ship is good of ſaile, and according as both wind and tide ſhall ſerue.

The meanes to attaine to this Art, as to all other Arts, are two parts, whereof euery Art conſiſteth, that is, Methode and Practiſe, which is as much to ſay héere, as inſtruction and experience: For of the chiefe points of this Art, ſome are to bée learned by inſtruction, and ſome onely by experience: for what inſtruction I pray you will ſerue to make a good coaſter, that is to ſay, to know any Cape or Cliffe when hée ſéeth it, vnleſſe he hath firſt ſéen it and hath before taken good markes thereof. Alſo to know the currents in all places, the depth and qualities of waters

waters, ſands, flats, or ſhoulds, and ſuch like, the perfect knowledge whereof conſiſteth chiefly in experience. Of which experience I mind not héere to treate, becauſe I know that a Dutchman called Wagoner, or Aurigarius, hath lately written of theſe things notably well, and eſpecially for theſe our Seas, and the Northeaſt Seas, whoſe booke I doubt not, but that ſome of our learned Sea-men will ſet forth in our mother tongue, with ſome augmentation of their owne experience for the Eaſt and Weſt Indies, for the profit of their Countrey, and to their owne praiſe & commendation. In the meane time I will procéed with inſtruction, the chiefe points whereof are theſe thrée following: firſt to know the vſes of ſuch inſtruments, as euery ſkilfull Sea-man ought to haue with him, that mindeth to ſaile any long voyage, which are theſe thrée following: Firſt, a perfect Kalender or Ephemerides, the Marriners ring or Aſtrolabe, the Croſſe-ſtaffe called of yͤ Spaniards Balla ſtella, the two Globes both Celeſtiall and Terreſtriall: Of all which things I haue in a manner already written ſeuerall Treatiſes. Item, an vniuerſall Horologe, or Diall, to know thereby the houre of the day in euery Latitude, and a Nocturnall able to know thereby the houre of the night. And it were neceſſary for him that ſaileth long voiages, to carry with him a Topographicall inſtrument to deſcribe thereby thoſe ſtrange Coaſts and Countries whereby he ſaileth; the vſe of which Inſtrument is plainely taught by William Borne, in his booke called the Treaſure of Trauellers, and by Maſter Digges, in his booke called the Pantometria, wherefore I ſhall not néed to ſpeake any further thereof. Alſo the Marriners compaſſe, whereof I do not onely make a plaine deſcription, and ſhew the vſes thereof, but alſo how to finde out the variation of the ſame, according to the precepts of the beſt moderne writers thereof. And laſtly the Marriners Carde, whereof whileſt I ſpeake, I doe not onely ſhew the making thereof, and how to draw the Parallels, in better ſort then they are vſed to bée drawen in the common Cardes, but I ſet downe therewith the chiefeſt vſes of the Card, amongſt which is taught how to know by helpe of the Carde, and certaine Tables made of purpoſe, what way your ſhip hath made in ſailing by any rombe or wind, yea in ſailing

right Eaſt & Weſt, which heretofore (as Cogniet ſaith) hath bin thought a thing vnpoſſible to be knowen, but only by coniecture: And being out of the way, how to know in what place you are, & to marke the ſame in your Card, that you may the more readily direct your ſhip againe, to the place whereunto you would goe. But all theſe inſtruments ſerue to little purpoſe, vnleſſe you know alſo the North ſtar, with his guards, & diuers others ſtars ſituated aſwell towards the North as towards the South pole, together with their Longitudes, Latitudes, declinations and greatneſſe, to know thereby the Latitude of any place, and the houre of the night: alſo the courſe of the Sunne and his declination, by helpe whereof you may know the Latitude of any place, the times and ſeaſons of the yéere, the houre of the day, and the length of the day and night in euery latitude. And finally, you muſt know the courſe of the Moone, whereon dependeth the knowledge of the tydes in all places: Of all which things I minde héere to treat in ſuch order as the Chapters hereafter following doe ſhew.

A generall Kalender or Almanacke for euer, containing theſe nine Chapters next following.

A generall Kalender or Almanacke for euer.

WHat this word Kalends ſignifieth, & from whence it is deriued, is before ſet downe in the firſt booke of my Treatiſe of the Spheare, the 45. Chapter. But becauſe there be generall rules to know the coniunction of the Moone with the Sunne, her full, and all her foure quarters, and alſo the moueable feaſts and Dominicall letter, and ſuch like things, eaſily to bee learned without the helpe of any particular Kalender, I thought good firſt to ſet downe this generall Kalender, containing 9. propoſitions, as followeth.

CHAP. I.

How to find out the Golden number euery yeere.

THe Golden number is the number of 19. proceeding from 1. to 19. and ſo to beginne againe at 1. And it is ſo called becauſe it was ſent in golden letters from Alexandria in Egypt to Rome: for in 19. yeares the Moone doth make all her ſundry motions and changes, and returneth againe to the place where ſhe firſt began. And to find the foreſaid number, the way is thus. Adde 1. to the yeere of the Lord whereof you enquire and diuide the ſame by 19. and the remainder ſhall be the Golden number for that yeere. As for example, being deſirous this preſent yeere 1590. to know the Golden number, I adde 1. to the ſaid yeare, and ſo make it 1591. which being diuided by 19. there remaineth 14. which is the Golden number of this preſent yeere.

But when there is no remainder, then 19. is the golden number, and remember that the Golden number beginneth alwaies at the firſt of January, and the Epact the firſt of March.

How

CHAP. II.

How to find out the Epact in euery yeere.

THe Epact is a number not exceeding 30. becauſe the Moone betwixt change and change, neuer paſſeth 30. dayes, and thereby the common Lunar yeeres conſiſting of twelue Moones is leſſer then the Solar yeere by 11. dayes, for to euery Moone are attributed no more but 29. dayes and a halfe, which make in all 354. dayes, ſo as the common Solar yeere conſiſting of 365. dayes exceedeth the Lunar yeere 11 dayes, from whence the Epact taketh his original, which Epact is found thus. Multiply the Golden number of the yeare by 11. the product whereof if it be vnder 30. then it is the Epact. But if the product bee aboue 30. then diuide the product by 30. & the remaynder ſhall be the Epact. As for example, to know the Epact in the yeere 1590. the Golden number being 14. as before: here hauing multipled the ſame by 11. and diuided the product therby by 30 I find the remaynder to bee 4. which is the Epact of the ſayd yeere. Alſo by knowing one former Epact, you ſhall haue it euer after by adding thereunto 11. and if the number doe exceed 30. then you muſt diuide the ſame by 30. and the remaynder ſhall be the Epact as by adding 11. to 4. I know the Epact ſhall bee the next yeere which is 1591. the number of 15. and by adding 11. to 15. the Epact in the yeere of our Lord, 1592. ſhall bee 26. and ſo forth.

CHAP. III.

How to know the Epact be the Mariners rule vpon your thumbe.

FIrſt, you muſt ſuppoſe the inſide of your left thumbe to be deuided into three ſpaces, and the nethermoſt ſpace to contayne 10. the middle ſpace 20. and the higheſt ſpace toward your thumbes end, to contayne 30. and knowing firſt the Golden Number, beginne to tell the ſame at the nether ſpace, ſaying there 1. at the middle ſpace

two

two at the third ſpace 3. then begin againe at the loweſt ſpace, & there ſay 4. and ſo continue your account ſtill, after that manner vntill you haue the full ſumme of the golden number, and mark vpon what ſpace the full ſumme falleth, for the Golden number being added to the number of that ſpace, doth ſhew the Epact, ſo as the totall ſumme doth not exceed 30. for then you muſt ſubtract 30. and the remaynder ſhall be the Epact: as for Example, in the yeere 1591. the Golden number is 15. which being counted vpon your thumbe, in ſuch order as is before taught, it will fall vpon the higheſt ſpace which is 30. to which if you adde the Golden number, which is 15. it will make in all 45. from which ſumme, if you ſubſtract 30. there will remayne 15. which ſhall be the Epact for that yeere, ſo as the Epact and Golden number in that yeere are like numbers. For euery three yeeres they are alwayes like, as when the Golden number, is either 3.6.9. 12.15. or 18. the Epact hath alſo like number.

CHAP. IIII.

How to know the age of the Moone in euery Moneth throughout the Yeere.

ADde to the Epact the number of monethes from the beginning of March, together with the moneth wherein you ſeeke, and alſo the number of the dayes paſt of that moneth, wherein you ſeeke, and the ſumme of ſuch Addition will ſhew you the age of the Moone, as for Example, I would know the age of the Moone the ſixt day of December, in the yeere 1590. Here knowing the Epact of that yeere to be 4. I adde thereto the number of the monethes from the beginning of March, which are 10. monethes, and alſo the number of dayes of December, which are ſix and the ſumme thereof is the age of the Moone, if the ſumme bee leſſe then 30. But if the ſumme of ſuch addition doe exceed 30. then you muſt ſubſtract 30. and the remaynder ſhall be the age of the Moone, ſo as the moneth wherein you ſeeke haue 31. dayes, for if it hath leſſe then 31. daies, then you muſt ſubtract but 29. and the remainder ſhall be the age of the Moone: as for example, ſuppoſe you ſeeke the age of the Moone the 22. of Nouember, in the yeere, 1589. in which yeere the Epact was 23. heere by adding to the Epact, firſt 9. moneths, and then twentie two daies, it maketh in all, 54. out of which by ſubtracting 29. becauſe Nouember hath but 30. daies, the remainder is 25. which was the age of the Moone in that moneth, day, and yeere.

CHAP. V.

How to know the change, the full, and foure quarters of the Moone euery moneth throughout the yeere.

MArtin Cortes, in his booke called the Art of Nauigation teacheth a rule to finde the day of the change, in euery moneth by knowing the age of the Moone that day you ſeeke, and then by reckoning from that day backward the number of the daies that went next before, or elſe by taking the age of the Moone out of the daies of the moneth that went next before: as for example, the laſt of October 1592. I find by the fourth propoſition, the age of the Moone to bee 5. which being taken out of 31. (for ſo many daies October hath) there remaineth 26. which day by this meanes ſhould be the day of the change, but the very day indeed was the 25. of the ſayd moneth, for the former rule to know the age of the Moone is not ſo true it ſelfe, but that ſometime it will fall a day either ouer or vnder. But Gemma Friſius, teacheth to find out the day of the change in euery moneth thus. Adde to the Epact the number of the moneths from the beginning of March, whereof that moneth wherein you ſeeke the change, muſt bee counted as one, and then ſubtract the product or ſumme of that addition from 30. and the remainder will ſhew the day of the change, which rule I finde to be true ſo long as the ſumme of the addition doth not exceede 30. but when the ſumme of the addition is more then 30. which will commonly chaunce when the Epact is a great number, as 26. or 29. he teacheth no rule for that, wherefore I thinke

thinke it beſt to take that ſumme out of 59.and the remainder ſhall be the day of change, or at the moſt but one day ouer or vnder, and hauing the day of the change, you ſhall haue the day of the full by adding 15. daies more to the day of change: and hauing the change and the full, you ſhall eaſily haue all her foure quarters by adding or ſubtracting 7.daies.

CHAP. VI.

How to know in what ſigne and degree the Moone is euery day throughout the yeere.

SOme doe ſet downe rules to know in what ſigne and degree the Moone is euery day, but ſuch as are not true. And to ſay the truth, the Moone hath ſo many diuers motions as it cannot bee done but by ſpeciall Tables, calculated of purpoſe. And by what rule ſoeuer you worke, you muſt firſt know the place of the Sunne, which the Ephemerides moſt truly ſheweth, and in looking for that, you ſhall alſo finde hard by it the place of the moone, that is to ſay, in what ſigne and degree ſhe is euery day, and ſo orderly the place of any other Planet, and therefore I leaue to ſpeake any farther thereof.

CHAP. VII.

How to find out the mooueable Feaſts euery yeere, onely by knowing the day of coniunction in the moneth of February.

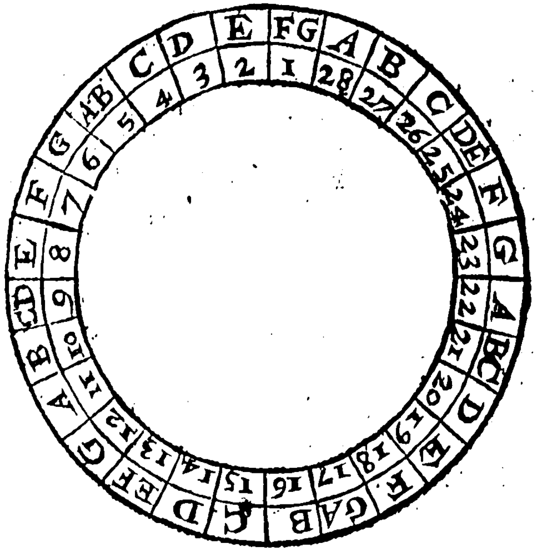
THe way to find out the coniunction in euery month is before taught in the fift Chapter. And hauing the day of the coniunction in February, you may aſſure your ſelfe that the next tueſday following is alwaies Shrouetueſday, for though the Coniunction it ſelfe doe fall vpon a Tueſday, yet the next Tueſday after that ſhal be Shrouetueſday, and the next Sunday after that, is called Quadrageſima, which is the firſt Sunday in Lent, and fiue weekes next after that is Eaſter day, whereunto if you adde fiue weekes more, that is to ſay, 35.daies, you ſhall haue Rogation Sunday, and foure daies next after that is Aſcenſion day, and tenne daies next after Aſcenſion day, is Pentecoſt or Whitſunday and ſeuen daies next after that, is Trinitie Sunday, and foure daies next after that, is the Feſtiuall day, called Corpus Chriſti. And you haue to note that the Sunday called Aduentus Domini, which we call the firſt Sunday in Aduent, is alwaies yͤ fourth Sunday before Chriſtmaſſe day, & the Sunday called Septuageſima is the third Sunday before Quadrageſima, otherwiſe called the firſt Sunday in Lent, and betwixt Septuageſima and Quadrageſima, there are other two Sundaies, whereof that which next before Quadrageſima, is called Quinquageſima, and the next Sunday before that is called Sexageſima.

CHAP. VIII.

How to find out the Circle of the Sunne, called in Latine by a Greekiſh name Cyclus Solaris, *and thereby the Dominicall Letter in euery yeere.*

THis Circle was inuented more to finde thereby the Dominicall Letter, then to ſhew any great changes of the Sunnes motions therein. And becauſe there bee ſeuen daies in the weeke, commonly ſignified by ſeuen leters, A.B.C.D.E.F.G. This Circle therefore is made to containe twenty eight yeeres, for foure times ſeuen doe make twenty eight, by helpe whereof is knowne the true order of the Letters, whereof A. ſignifieth alwaies the firſt day of euery yeere, and for euery leape yeere are appointed two Dominicall Letters, whereof the one continueth from the beginning of that yeere vntill Saint Mathias euen, and the other from thence to that yeeres end, as you ſhall more plainly perceiue by that which followeth. And firſt, I will ſhew you how to find out the iuſt number of the Circle of the Sunne, euery yeere which is done thus.

Adde to the yeere of the Lord giuen or ſuppoſed 9. and diuide that product by 28. and the remainder ſhalbe the number of the foreſaid Circle. As for example, I would know the number of the ſaid Circle in the yeere 1590. wherunto by adding 9. I make the ſumme to be 1599. which being diuided by 28. there remaineth 3. Now to find out the Dominicall Letter, by the number of the ſaid Circle, you muſt reſort to the figure following, conſiſting of three Circles, making two ſpaces, in the vpper ſpace whereof are ſet down the foreſaide ſeuen letters, and in the nether ſpace, the numbers of the Sunnes Circle, in ſuch ſort as euery number hath his proper Dominicall letter, ſtanding right ouer his head, and for euery leape yeere, there are ſet downe two Dominicall Letters. All which letters are to be counted backward, and not forward as they are placed in the Almanackes. As for example, hauing found the number of the Sunnes Circle for the yeere 1590. to be 3. in the lower ſpace, you ſhall find out the letter D. ſtanding ouer his head, which is the Dominicall letter for that yeere. And note that when 28. is the number of the Sunnes Circle, A. is alwaies the Dominical letter, from which number, you muſt beginne to count againe at one, and ſo proceede backeward to 28.



CHAP. IX.

How to find out the number of Indiction.

THis number conſiſteth of 15. yeeres, and is commonly ſet downe in all the Charters of the Biſhops of Rome, and in the inſtruments and writings of their Pronotaries, and therefore is called Indictio Romana, wherein they ſeeme to follow the ancient Romans, which vſed the like indiction of yeeres, but to other purpoſes, whereof I make mention in my Spheare. The way to find out this number euery yeere is thus. Adde to the yeere of the Lord giuen, three, and diuide the product thereof, by 15. and the remainder ſhall be the number of the ſaid indiction. But you haue to vnderſtand, that this Indiction is to be counted from September, and not from March, as is the Epact.

But the ſureſt, and therewith the moſt generall Kalender to ſerue in all places, is the Ephemerides, or daily Almanacke, and eſpecially that of Origanus, which wil ſerue for many yeeres yet to come: And before thoſe yeeres be all expired, I doubt not but that the like will be ſet forth by ſome one or other of our learned Aſtronomers, amongſt whom for many yeeres paſt, the Germaines haue beene moſt famous. I choſe the Ephemerides of Stadius, which is now expired, and many other good ones lately ſet forth, becauſe he is more portable, and of leſſe price, then that great Ephemerides of Leouitius. The chiefeſt vſes wherof, and moſt meet for Marriners, though I haue already ſet downe in the latter end of my Treatiſe of the Globes, to the intent, you might by the helpe thereof, find out in the Globe the true place of the Moone, and of euery one of the other fiue Planets, that hath both Longitude and Latitude; yet I thinke it good once againe heere in this place, moſt properly requiring the ſame, briefely to ſhew the vſe of the ſaid Ephemerides, and ſpecially of the diurnall Table, which beginning at the yeere of our Lord 1583. endeth with the yeere 1606.

CHAP. X.

A briefe deſcription together with the vſe of the diurnall Table or Almanacke of Iohannes Stadius.

This deſcription is alſo proper to any of the other, and may be readily applied therto.

THis Table beginneth at the 202. Page of his booke called the Ephemerides, or daily Almanacke. And euery page of the ſaid Table, that is on the left hand is diuided into nine collomes. In the firſt collome whereof, on the left hand, are ſet downe the daies of the moneth. Firſt, the Gregorian dayes, according to the Romane account, and next to that the daies of the moneth according to our English account, and then in the front of euery other collome, are ſet downe the characters, firſt of the Sunne and then of the other ſixe Planets, that is to ſay, of the Moone, Saturne, Iupiter, Mars, Venus, Mercury, and laſt of all, the head of the Dragon, figured thus ☊. And right vnder the ſeuen planets, and alſo vnder the head of the Dragon, are ſet downe the ſignes and degrées, wherein euery of theſe is euery day of the moneth throughout the yeere at noonetide. And in the foote of the ſaide Table is ſet downe the Latitude of euery one of the fiue Planets, procéding by the daies of the month, diuided into thrée parts. And in the margent of euery left page, are ſet downe the chiefeſt feaſts and Saints daies, that fall in euery month throughout the yéere. And moreouer, in the Table on the right hand, right againſt the left Table are ſet downe, firſt the daies of the month, and then what coniunction, or any other aſpect, the Moone hath with any of the other ſixe Planets, that is, with the Sunne, with Saturne, with Iupiter, with Mars, with Venus, and with Mercury, which Planets are ſet downe in the front of the ſaid Table, and vnder them the Characters of ſuch aſpects as the Moone hath that day with any of the other Planets. The Characters of which aſpects are theſe héere following:

☌ ☍ △ □ ⚹

Whereof the firſt ſignifieth a Coniunction, the ſecond an oppoſition, the third a trine aſpect, the fourth a quadrat aſpect, and the fift a ſextile aſpect.

Two Planets are ſaid to be in a coniunction, when they are both in one ſelfe ſigne.

And to be in an oppoſition when they are in two ſeuerall ſigns diſtant one from another 180. degrées, which is ſixe whole ſignes or one halfe of the Zodiaque.

And to be in a trine aſpect, when they are diſtant one from another by foure ſignes, or one third of the Zodiaque.

And to be in a quadrat aſpect, when they are diſtant one from another by thrée ſignes, which is 90. deg. or $\frac{1}{4}$. of the Zodiaque.

And to be in a ſextile aſpect, when they are diſtant but two ſignes one from another.

CHAP. XI.

How to find out the place of any Planet by the Ephemerides.

NOw to find out the place of any Planet, or of the head of the Dragon by this diurnall table, you muſt firſt ſéeke out the day of the moneth in the firſt collome of the left Table, and right againſt that on your right hand in the ſaid left Table, you ſhall find in the common Angle, right vnder the Planet or Dragons head, which ſo euer of them you ſéeke, the ſigne and degrée wherein the ſaid Planet Dragons head, is the ſaid day at noonetide.

And to find out the aſpects which the Moone hath with any of the Planets the ſame day, you muſt reſort to the other Table on the right hand, obſeruing like order as before.

The Examples.

As for example, the 21. of Aprill, 1592. which is the firſt of May according to the Romane account, I find by the Table on ẏ left hand, the Sunne to be in the 10. degrée, 15. minutes of Taurus, the Moone to be in the third degrée, 47. minutes of Capricorne, Saturne to be in the 8. degrée, 10. minutes of Cancer, Iupiter, to be in the 18. degrée, 28. minutes of Sagittarius, Mars, to be in ẏ 12. degrée, ſix minutes of Gemini, Venus, to be in the ſecond degrée, 0. minutes of Aries, and Mercury to be in the 6. degrée, 20. minutes of Taurus, and the head of the Dragon to be in the 29. degrée, 45.

minutes of Gemini. And right againſt this in the Table on the right hand, you ſhall finde the Moone to be in a trine aſpect with the Sunne, to be in an oppoſition with Saturne, to bee in a trine aſpect with Mercury.

Thus much touching generall Kalenders or Almanackes. Now as for particular Kalenders, I take that which Robert Norman hath ſet downe in his new attractiue to be the fitteſt for our country men, which containeth many neceſſary things, as the contents thereof, together with the Table next following the ſame, doth ſhew, which Kalender I thinke it ſuperfluous to be ſet down againe here, and the rather for that I wiſh euery Mariner not to be without that booke, and eſpecially containing beſides the Kalender, many other good precepts touching Nauigation, to which booke is alſo ioined a very learned and Mathematicall diſcourſe, touching the variation of the Marriners compaſſe, made by Maſter William Borough controuler of her Maieſties Nauie, who in mine opinion is one of the ſkilfulleſt men in the Art of Nauigation that is in this Realme.

CHAP. XII.

Of the Marriners Ring or Aſtrolabe, and of his Croſſe-ſtaffe.

NOw according to the order ſet downe in the beginning of this Treatiſe, I muſt needs ſpeake ſomewhat of the common Mariners Ring, or Aſtrolabe, and of his Croſſe-ſtaffe, which ſerue not to ſo many purpoſes, as that of Stofflerus or of M. Blagraue before diſcribed, but onely to take the altitude of the Sun, or of any ſtarre, or planet, neither are ſo many concluſions to be wrought by their common croſſe-ſtaffe, as by that of Gemma Friſius, or by that which Maſter Hood hath lately inuented. Sith our Marriners for the moſt part doe vſe their common Croſſe-ſtaffe to none other end, but either to take the altitude of the Sunne, or of any fixed ſtarre or planet, or elſe to take the diſtance betwixt two Stars, the making of which ſtaffe is plainely ſet downe by Martin Cortes, in his Art of Nauigation, and alſo the making of their Aſtrolabe.

But Cogniet and Wagoner do ſet downe a new kind of croſſe-

ſtaffe, hauing 3. tranſames or croſſes, euery one longer & ſhorter then other by the one halfe, affirming that ſo many concluſions may be wrought thereby, as by yͤ of Gemma Friſius, but in mine opinion they are not to be cõpared in al reſpects to that of Gemma Friſius, which though by reaſon that the yard thereof is of ſo great a length, as it is not maniable in a ſhip, yet vpon yͤ land it is moſt ſeruiceable, nor yet to that of M. Hoods inuention, which is moſt maniable, and therwith very light of carriage, by whoſe ſtaffe, I think verily that as many things may be wrought, as by any other kind of croſſe-ſtaffe whatſoeuer, & with leſſe trouble, yea, and in matters of Aſtronomy more truly, by reaſon that the yard and tranſame be of one ſelfe length, and therby the degrees be larger, throughout the whole quadrant, then they be in the cõmon croſſe-ſtaues, for in thẽ, the degrees from 50. vpwards to 90 are very ſmall, and haue narrower ſpaces then M. Hoods ſtaffe hath. Againe, wheras in vſing the Marriners croſſe-ſtaffe in ſuch latitude, as the Suns beames be of great force, they are faine to haue glaſſes made of purpoſe to ſaue their ſight, and in ſome places all too little. But in vſing M. Hoods ſtaffe, they ſhall not need to behold the Sunne it ſelfe at all, but only to marke vpon what degree of the yard, the ſhadow of the Vane ſtreeketh. Moreouer, when the Sunne or ſtar is 50. or 60. degrees high, they are faine to vſe their Aſtrolabe & not their ſtaffe, which Aſtrolabe in mine opinion, as I haue ſaid before, is the beſt inſtrument of al others to take the altitude of the Sunne in the day, or of any ſtarre in the night, and becauſe I haue heere commended vnto you M. Hoods ſtaffe, I will firſt ſet downe a plaine deſcription thereof, together with thoſe few Aſtronomicall vſes which doe chiefly belong to the Mariner, without committing any offence, I hope, to the Author thereof, and then I will diſcribe vnto you the Mariners ring, & his common ſtaffe together with yͤ vſes of the ſame.

But as I was about to deſcribe vnto you, M. Hoods ſtaffe, a friend of mine comming in the meane time, deſired mee that I would firſt ſet downe the making and vſe of the croſſe-ſtaffe, with three Tranſames, which Wagoner and Michael Cogniet doe ſo much commend, and as I heare, is vſed of many Sea-men in theſe daies, whoſe requeſt I could not well deny, and therefore loe heere followeth both the making and vſe thereof.

Of the Croſſe-ſtaffe hauing three Tranſames or Curſours, commonly vſed in theſe dayes, the vſe and making whereof doth hereafter follow, according to the deſcription of Wagoner, *and* Michael Cogniet.

FIrſt, prepare a right ſtaffe of firme Wood, that is, ſquare euery way, bearing in thickneſſe three quarters of an inch, and in length three or foure foote, for which you muſt alſo prepare three Tranſames or Curſours, euery one ſhorter then another by the one halfe, for the longeſt would contayne in length twelue inches, the ſecond, ſix inches; and the ſhorteſt, or leaſt, three inches. And euery one of theſe Tranſames or Curſours muſt be cut with a ſquare hole in the very midſt, ſo as they may bee made to runne iuſt vpon the ſtaffe too and fro, theſe things being prepared, you muſt diuide three ſides of the ſtaffe into certaine degrees, to ſerue three ſeuerall Curſours, as followeth.

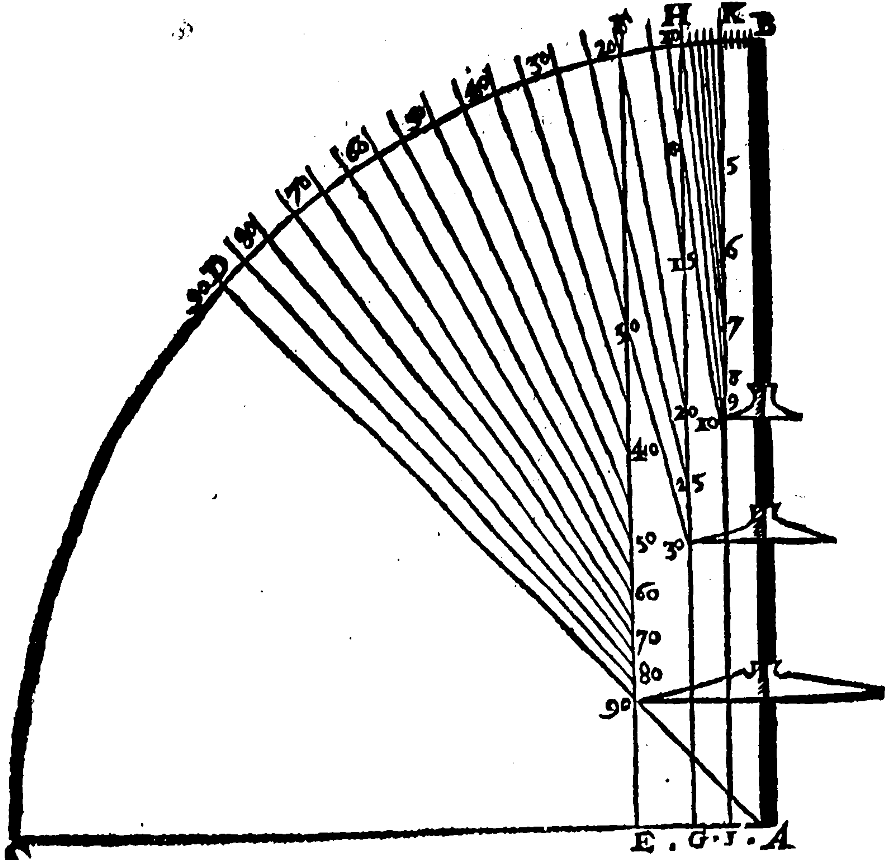
Firſt, you muſt vpon a ſmooth ſquare Table, ſomwhat longer euery way then the ſtaffe, & for want of one ſuch table you may ioyne two tables that may ſtand euen together, draw by help of a true long ſquire a right Triangle marked with the lettes, A. B.C. and let A. be the right angle, and the Centre as you ſee in the figure following and let both the ſides of the ſaid Triangle be of like length to your ſtaffe, then putting the one foot of your Compaſſe in the Centre A. and the other foote in B. or C. draw a quarter of a Circle from C. to B. and hauing diuided that quarter into two equall parts, make a pricke in the middeſt marked with the letter D, and laying your ruler to that prick, and to the Centre A. draw a right line, which ſhall be A.D. then diuide the halfe Quadrant, D.B. into nine equall parts, making 90. equall degrees, proceeding from B. to D. ſo as the firſt degree may be at B. and the 90. at D. that done, take with your Compaſſe the iuſt halfe of the longeſt tranſame, & keeping your Compaſſe at that wideneſſe, ſet the one foot in the Centre A. and the other foot in the line A.C. ſo farre as that wideneſſe will extend, and there make a pricke marked with the letter E. then from that point draw a right line that may be a Parallel to the line A. B. which

line

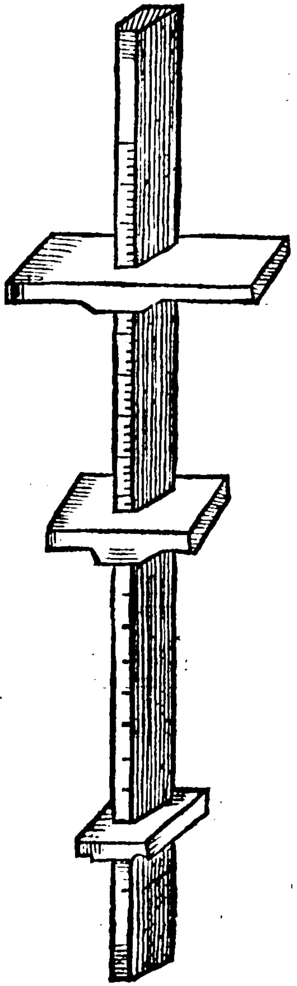
line ſhall be I. F. then take with your Compaſſe the halfe of the middle Tranſame, and keeping your compaſſe at that widenes, ſet the one foot in A. and the other foot in the line A. C. ſo farre as that wideneſſe doth extend, and there make a pricke marked with the letter G. and from that pricke draw a right line that may be a Parallel to A.B. which line ſhal be G.H. Thirdly, take the one halfe of the leaſt tranſame with your compaſſe, & transferre that wideneſſe to the line A.C. ſetting the one foot of your compaſſe in A. and make a prick with the other foot in the line A C. as before marked with the letter I. and from that prick draw another right line that may be a Parallel to the line A.B. which ſhall be in the line I.K. Now to graduate the firſt ſide of your ſtaffe to ſerue the longeſt Tranſame, you muſt lay the Ruler to the centre A. and draw right lines from thence to euery degree of the circumference contained betwixt 90. and 30. and thoſe lines ſhall diuide the line E.F. into ſo many vnequall ſpaces, as do belong to the firſt ſide of the ſtaffe, for you muſt lay the firſt ſide of the ſtaffe to that line, to be marked according to the diuiſion of that line, the nether ſection whereof towards the lower end of the ſtaffe muſt be marked with 90. & the vpper ſection with 30. ſo is the firſt ſide of your ſtaffe truly diuided to ſerue the longeſt Tranſame: now to ſerue the middle Tranſame you muſt diuide the line G.H. by drawing right lines from the centre A. to euery degree of the circumference contained betwixt 30. and 10. which lines wil diuide the line G.H. into vnequal ſpaces, of which ſpaces, the loweſt muſt be marked with 30. and the higheſt with 10. according to which diuiſions, you muſt marke the ſecond ſide of your ſtaffe by laying the ſide cloſe to the line G. H. ſo ſhall that ſide be marked to ſerue the middle Tranſame, then lay your ruler againe to the Centre A. and draw right lines to euery degree of the circumference cōtained betwixt 10. and the firſt or ſecond degree next to B. and thoſe lines ſhall diuide the line I.K. into vnequall ſpaces, the loweſt whereof is to be marked with 10. and the higheſt with 2. or 5. according as your inſtrument wil beare, and according to thoſe ſections you muſt diuide the third ſide of your ſtaffe, by laying the ſame cloſe to the ſaid line I. K. and remember to make your lines of diuiſion ſo finely as is poſſible, ſo

ſhall

ſhall your ſtaffe be the more truly graduated. And note, that in graduating your ſtaffe, you ſhall not néed to draw right Lines from the Centre to euery degrée of the circumference, contained betwixt the 90. degrée and the 60. degrée; for when the Sunne or any Starre is higher then 60. degrées, you muſt vſe your Aſtrolabe, and not your ſtaffe, which will not ſerue you to looke ſo right vp, to take ſo great an altitude, either of Sunne or Starre.



A figure of the foreſayd Triangle.



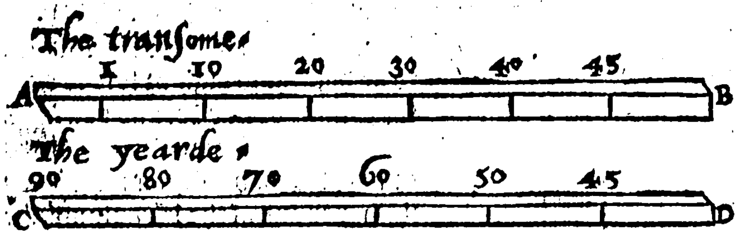
The ſhape of the ſtaffe with his three Tranſomes, together with the vſe thereof.

Whenſoeuer you would take the Altitude of the Sunne or of any Starre, you haue firſt to conſider whether the Sunne or ſtarre be 30. degrées or more high: for then you muſt place the longeſt Tranſame vpon your Staffe. And ſet the lower end of your ſtaffe marked with ninety to your eie, which is alwaies to be done how high or low ſo euer the Sunne or ſtar be, and you muſt moue ẏ Tranſame, either forward or backward, vntill you may ſée by the vpper end of the Tranſame, the body or middeſt of the Sunne or ſtarre, and with the neather end of the Tranſame, the Horizon; and then looke in what degrée the Tranſame cutteth the ſtaffe, for that is the Altitude of the Sunne and ſtar at that preſent, but if ẏ Sun be not 30. degrées high, then you muſt put on the middle Tranſame, and if he be leſſe then ten degrées high, you muſt put on the ſhorteſt tranſame, and then do as before. Thus much touching ẏ Croſſe-ſtaffe with thrée Tranſames, now I will deſcribe vnto you Maſter Hoods ſtaffe, and ſhew you the vſe thereof.

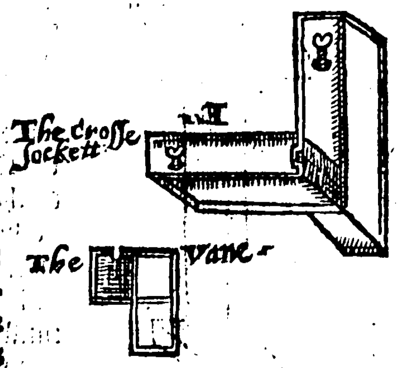
CHAP. XIII.

A briefe deſcription of Maſter Hood *his Croſſe ſtaffe, and of all the parts thereof.*

The figure, or ſhape of euery part of the ſaid Staffe.



This inſtrument as you ſee, conſiſteth of foure parts.



Firſt, of 2. ſquare rulers, each one bearing in thickeneſſe thrée quarters of an inch, or thereabouts, euerie way ſquare, and in length, I would wiſh each ruler not to containe aboue one yard, for then in ſome vſes they would waxe too heauie.

Of which two rules the one marked with the letters A. B. is called the tranſame, which is diuided on the one ſide into 45. degrées, beginning at one, and ſo forth to 45. And euery degrée is diuided againe into ſixe leſſer parts, making 60. minutes, for ſix times ten maketh 60. which ſerueth for Aſtronomicall vſes.

And on the oppoſite ſide to that, the ſaid Tranſame is diuided into 1000. equal parts, beginning at 25. and ſo increaſeth by 25. vntill you come to 1000. Euery which 25. parts is diuided into fiue leſſer parts, and euery one of thoſe againe into fiue parts, which maketh in all 25. for fiue times fiue is 25. and this ſerueth for Geometricall vſes.

The other ſquare ruler called the yard, and marked with the Letters C.D. is diuided into degrées like to thoſe of the Tranſame, procéeding from 45. to 90. which together with thoſe degrées that be in the firſt ſide of the Tranſame, doe make vp the number of a iuſt Quadrant, to ſerue Aſtronomical vſes. And the ſide oppoſite to that is diuided into 1000. equal parts, procéeding from 25. to 25. like in all reſpects vnto the oppoſite ſide of the Tranſame to ſerue Geometricall vſes.

The third part belonging to this inſtrument, is a double ſocket of braſſe, marked with this letter E. ioyned together wᵗ right Angles, and ſtanding croſſe one to another. And each ſocket hath a ſkrew to kéepe the ſame faſt to his ſtaffe, at any degrée that you liſt to ſet the ſame: and alſo a long notch, to the intent it may be layd cloſe to any degrée of the Ruler, whereto it belongeth.

The fourth part belonging to this inſtrument, is a Vane of braſſe marked with the letter F. the vpper edge whereof is pierced with a little round hole for the beame of the Sunne to paſſe through the ſame. And this Vane is made with a ſocket, and with a ſkrew to hold it faſt to that ruler whereon it is ſet. And for certaine Geometricall vſes, it were neceſſary (as ſome thinke) that there were two ſuch Vanes.

Thus hauing deſcribed all the parts of the foreſaid Inſtrument I will now ſhew you how to ſet thoſe parts together: which to ſerue Aſtronomicall vſes, is thus done.

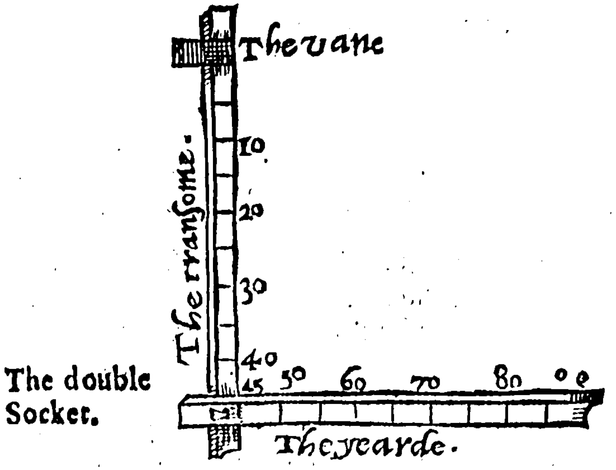
CHAP. XIIII.

How to ſet the parts of M. Hoods *ſtaffe together, to ſerue ſuch Aſtronomicall vſes as doe chiefly belong to the Mariner.*

FIrſt put the nether end of the Tranſame marked with the 45. degrée into the double ſocket, ſo as ẏ Tranſam may ſtand right vp, and that the notch of the ſocket may méet euen with the ſayd 45. degrée, & turne the ſkrew that the ſocket may ſtand faſt at that degrée, that done, put the yard into the croſſe ſocket, ſo as the notch of the ſaid croſſe ſocket may lye iuſt vpon the 45.degrée of the yard, and there make it faſt by turning the ſkrew: then put on the Vane, which to ſerue Aſtronomicall vſes, muſt be ſet at the higheſt end of the Tranſame, in ſuch ſort as the vpper edge of the Vane pierced with yͤ hole, may ſtand euen with the firſt point or ſtréke of the ſaid Tranſame, & when the Tranſame ſtandeth on the left hand of the yard, then the vane muſt be placed on yͤ right ſide of the Tranſame: But if the Tranſame do ſtand on the right hand of the yard, then the vane muſt be placed vpon the left ſide of the Tranſame: And the yard and Tranſame would bee ſo ſet together, as the degrées of the Tranſame procéeding downward from one to 45. may looke towards you, that is to ſay, may ſtand right before your face: And the degrées of the yard procéeding from 45. to 90. would lye vpward, ſo as the end of the yard marked with 90. may point to your breſt, or ſet to your eye as occaſion ſhall require, for ſuch Aſtranomicall vſes as héere doe follow.

CHAP. XV.

The ſhape or figure of the foreſaid ſtaffe, hauing all his parts ſet together to ſerue for Aſtronomicall vſes.



CHAP. XVI.

How to take the altitude of the Sunne at any houre that he is to be ſeene with the eye, by M. Hoods *ſtaffe.*

THe Staffe being ſet in ſuch order as is before taught, goe into ſome open place whereas you may ſée the Sunne, and turning the end of the yard marked with ninety towards your breſt, hold the yard ſo leuel as you can, that it may be a iuſt Parallel to the Horizon, and turne both your face, and alſo the Vane of the Tranſame towards the Sunne. Then you haue to conſider whether the Sunne at that preſent be either iuſt 45.degrées high, or more, or elſe leſſe then 45.degrées, which you ſhall eaſily know thus: For if he be iuſt 45.degrées high, then the ſhadow of the vpper edge of the Vane, will ſtréke iuſt vpon the 90.degrée of the yard lying at your breſt. But if he be more then 45.degrées high, then the ſhadow of the Vane will ſtréke ſhort of the 90.degrée: And if it be leſſe it will caſt no ſhadow at all vpon the yard, but ſtréke cléne beyond it ouer your ſhoulder. Now knowing by this meanes whether the altitude of the Sunne be more or leſſe then 45.degrées, you ſhall take his true altitude thus.

If his altitude be leſſe then 45.degrées, then make the Tranſame to ſinke downe through his ſocket, vntill the vpper edge of the Vane ſtanding vpon the Tranſame, do caſt his ſhadow iuſt vpon the ninetéenth degrée of the yard. Then look at what degrée the notch of the Socket wherein the Tranſame ſtandeth, doth cut the ſaid Tranſame; for that is the true altitude of the Sun at that inſtant.

But if the altitude of the Sunne be more then 45.degrées, then drawe the double ſocket vpon the yard nigher towards your breſt: vntill you ſée the ſhadow of the Vane to fall iuſt vpon the ninetieth degrée of the yard, that done, looke vpon what degrée of the yard the notch of the double ſocket cutteth, and that is the true altitude of the Sunne at that inſtant.

CHAP. XVII.

How to take the altitude of any ſtarre with M. Hoodes *ſtaffe.*

There is no difference betwixt the order of the taking the altitude of the Sunne and of any ſtarre, but only that in taking the altitude of any ſtarre, you muſt ſet the end of the yard, marked with the 90. degrée to your eye, ſtaying the ſame vpon the vpper bone of your chéeke and that in ſuch ſort as you may ſée the ſtarre by a right line, paſſing from the end of the yard, lying at your eye, to the vpper edge of the Vane at one inſtant, being alwaies ſure that the yard lye leuel, making a iuſt Parallel to the Horizon, which Horizon is more eaſie to be ſéene vpon the Sea, then vpon the land, for on the Sea, there be neither hils nor trées to hinder the ſight thereof.

CHAP. XVIII.

How to take the diſtant betwixt two ſtarres with Maſter Hoodes *ſtaffe.*

The inſtrument being ſet in ſuch order as was firſt taught: Set the end of the yard, marked with 90. at your eye; and let the other end of the yard, directly point to one of thoſe ſtars whoſe diſtance you ſéeke, & turne the edge of the Vane to the other ſtar, be it on the right hand, or on the left, according as you think good your ſelfe: then you muſt conſider whether yͤ diſtance of the two ſtars be iuſt 45. degrées or more or elſe leſſe, for if it be iuſt 45. degrées then the outward edge of the Vane and the ende of the yerd, marked with 90. will be anſwerable in your ſight to that diſtance without any more adoe. But if the diſtance be leſſe then 45. degrées, which you ſhall eaſily perceiue by your eye (for then the Starre that is on your right or left hand, will appeare within the Vane and fall ſhort thereof) then you muſt thruſt downe the Tranſame in his ſocket, vntill you may ſée the two ſtarres by a

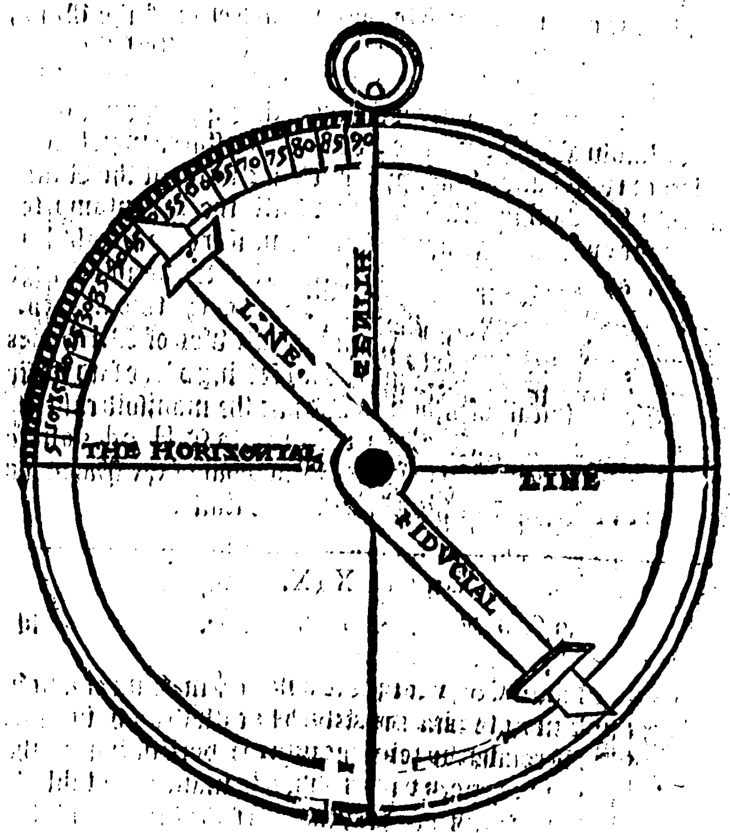
right line paſſing from the end of the yard marked with 90 .and lying at your eye, right forth to the outward edge of the Vane, that done, looke what degree the double ſocket cutteth the tranſame, and that ſhall be the true diſtance of the two ſtarres. But if the diſtance of the two ſtarres, be more then 45. degrées, which you may know alſo by your eye, becauſe the ſtarre which is on your left or right hand, will appeare cleane without the Vane: then draw the double ſocket together with the Tranſame towards your eye, vntill you may ſée the two ſtars by a right line as before, and the degrées which the notch of the double ſocket cutteth on the yard, ſhall be the true diſtance of the two ſtarres.

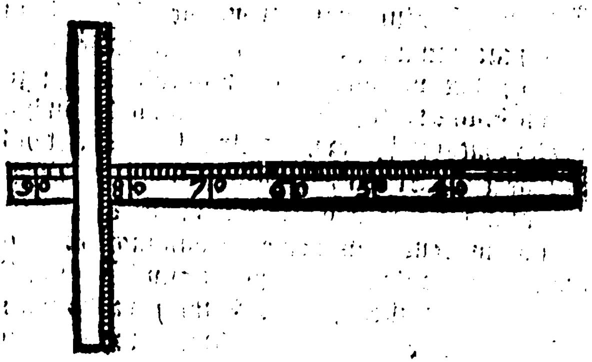
Thus much touching the Aſtronomicall vſes of M. Hoodes ſtaffe meet for the Marriner. Now as for ſetting of the ſaid ſtaffe to ſerue Geometricall vſes, and to find out the manifold concluſions to be done thereby, I wholly refer you to M. Hoodes owne booke, thinking it good now to ſpeake ſomewhat of the Mariners Aſtrolabe or Ring, and of his vſuall Croſſe ſtaffe.

CHAP. XIX.

Of the Marriners Aſtrolabe.

Michael Cogniet ſetteth downe yͤ making of a new kinds of Aſtrolabe, which he calleth an vniuerſall Aſtrolabe, onely becauſe the declination of the Sunne, euery day is added in maner of a table to the one end of the Diopter of the ſaid Aſtrolabe, which is of no great importance, ſith the Sunnes declination doth alter in the ſpace of 30. yéeres and leſſe, which being expired, the declination is to bée new calculated: In the meane time that Table which Norman hath ſet downe in his Attractiue, and alſo that which is more lately calculated, ſet downe by my ſelfe in the firſt part of my Spheare, and likewiſe in this Treatiſe: whereas I treate of the motion of the Sunne and of his declination, may ſerue theſe 20. yéeres and more without any great error: Wherfore leauing to ſpeake any further of Cogniet his vniuerſall Aſtrolabe, I will deſcribe héere the common Aſtrolabe and Croſſe ſtaffe vſed by moſt Mariners, the ſhape or figure of both which here followeth.





CHAP. XX.

A briefe diſcription of the Mariners Aſtrolabe and the vſes thereof.

THe limbe of the Mariners Aſtrolabe is traced as you ſée with thrée Circles, making two ſpaces to containe therein the degrées and numbers of altitude: and theſe Circles are diuided by two croſſe lines, called Diameters, and cutting one another in the very Centre of the Aſtrolabe, into 4. equall parts, of which quarters the vppermoſt on the left hand towards the Ringle, is onely marked with degrées and numbers, as you may ſée in the figure: In which figure the perpendicular Diameter ſignifieth the Zenith, or the line of South and North, at the vpper end whereby is faſtned the ringle or handle. And the other ouerthwart Diameter ſignifieth the Horizon, the one end whereof on the left hand ſignifieth the Eaſt point, and the other end on the right hand the weſt point. And to this Aſtrolabe (as to all other) doth belong a ruler or Diopter, which as you ſée hath at each end a ſquare tabled pearced with two holes, the one greater, & the other leſſer, the greater to looke through with your eye, to take the altitude of any ſtarre, or of the Sunne, being ſo darkened by ſome cloud as though it caſteth no ſhadow, yet it may be ſéene with the eye: And the leſſer hole is for the Sunnes beame to paſſe through when he ſhineth cleare, and ſome Aſtrolabes are diuided in like manner on both ſides of the Zenith, and haue two Diopters, whereof the one is pearced with a great hole, and the other with a ſmaller hole to ſerue to ſuch purpoſes as is aboue ſaid.

The vſe of this Aſtrolabe is onely to take the Altitude of the Sunne, at any time of the day, or of any fixed Starre or Planet in the night, in ſuch ſort as is before taught in my diſcription of of Maſter Blagraue his Aſtrolabe, in the third and fourth Propoſition thereof.

CHAP. XXI.

A briefe diſcription of the Mariners Croſſe-ſtaffe.

This ſtaffe conſiſteth of two foure ſquare rulers of wood, whereof the one is called the yard, and the other the Tranſame or Croſſe: And the yard containing in length moſt commonly three quarters of a yard, is the longer peece, and is diuided into 90. vnequall degrees: for from 10. to 90. the degrees doe grow leſſer and leſſer, and the Tranſame containing for ye moſt part but one third part of the yard, is cut with a ſquare hole in the middeſt, ſo as it may runne vp and downe vpon the yard, and ſome Tranſames haue two running Vanes to be ſet at what wideneſſe you liſt, to take thereby the diſtance of any two ſtarres.

CHAP. XXII.

The vſes of the Marriners Croſſe-ſtaffe.

The vſe of the Marriners ſtaffe chiefly conſiſteth in two points, that is, to know thereby the altitude of the Sun in the day time, or of any ſtarre in the night ſeaſon, and the other is to know therby the diſtance betwixt any two ſtars.

The firſt is thus done, hauing put the ſtaffe or yard through the ſquare hole of the Tranſame, ſet the end of the yard, which is marked with 90. to your eye, laying that end vpon ye vpper point of your cheeke bone, keeping your legs cloſe together, and hauing directed the other end of the yard towards the Sun or ſtar, whoſe altitude you ſeek, moue the Tranſame too & fro, or vp & downe, vntill you may ſee with the one eye (winking with the other) the one end of the Tranſame to meet iuſt with ye Centre or middeſt of the Sun or ſtar, and the other end to touch the Horizon both at one inſtant, & that degree of the yard, which the ſquare edge of the Tranſame cutteth, will ſhew how high the Sun or ſtar is at that preſent: And in taking the Altitude of the Sun or of any ſtar, remember alwaies to hold the yard ſo leuel, as it may be a iuſt parallel to the Horizon, for ſo ſhall you take the altitude the more truly. Now as touching the ſecond point, which is to know the the true diſtance betwixt any two ſtarres, you muſt doe thus.

Set the end of the yard marked with ninety to your eie as before, and moue the Tranſame too and fro, vntill you may ſee the one end of the Tranſame to anſwer the one ſtarre, and the other end thereof to anſwer the other ſtarre, for that degree of the yard which the Tranſame cutteth, will ſhew the diſtance betwixt the two ſtarres: And if the two ſtarres be ſo nigh together, as they will not conueniently anſwere the two ends of the Tranſame, then you may vſe the two moueable Vanes, which (as I ſaid before) you may ſet at what wideneſſe you liſt, but yet ſo as they may both ſtand equally diſtant from the Centre of the Tranſame, or from both ends thereof.

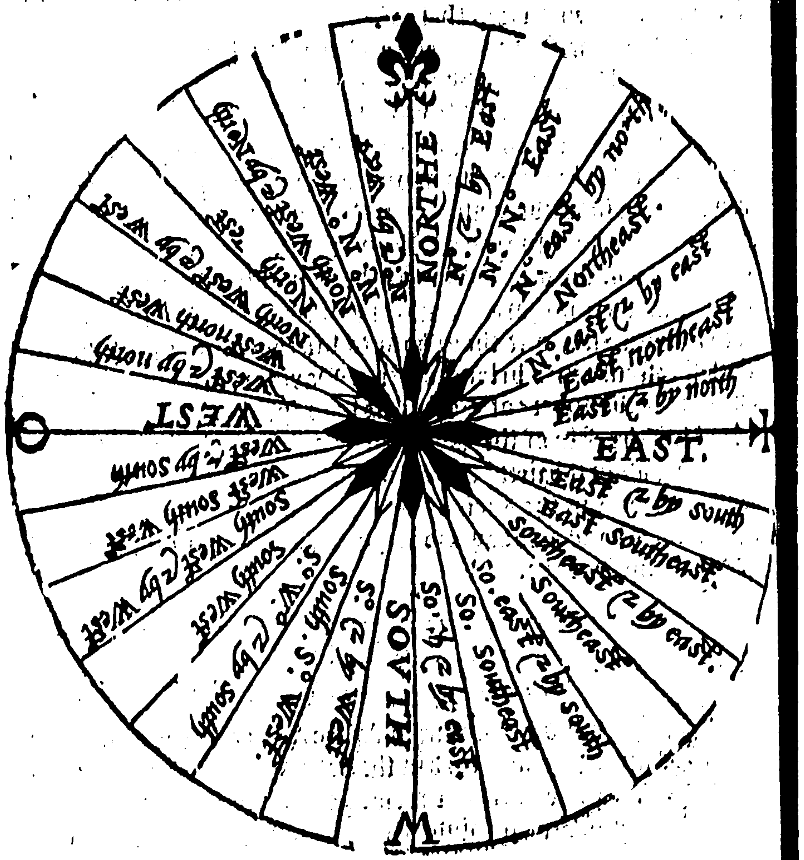
Thus hauing ſhewed the vſe of the Mariners Ring & croſſe-ſtaffe, I will now proceede to the other inſtruments, whereof the two Globes are part, which Globes I haue already deſcribed & ſhewed, the chiefe vſes thereof in a Treatiſe by it ſelfe, and as for the vniuerſall Horologe, to know thereby the equall houres of the day in euery latitude, & alſo by ye Nocturnall to know the houre of the night, I ſhal ſpeake of the one when I come to ſpeak of the Sunne, and of the other when as I treat of the North ſtarre and of his guards, for there I will ſet downe the figure and ſhape of each inſtrument, and ſhew how to vſe the ſame: But the two chiefeſt inſtruments belonging to a Mariner, are his Compaſſe and his Carde, whereof I come now to ſpeake.

But ſith the Fly of the Compaſſe repreſenteth the 32. winds, I thinke good firſt briefly to define what the wind is, and to ſhew how many winds the ancient Mariners did vſe, I ſay here briefly, becauſe I haue already ſpoken ſufficiently thereof in the latter end of my Speare.

CHAP. XXIII.

Of the wind, what it is, and of diuers kinds and names therof.

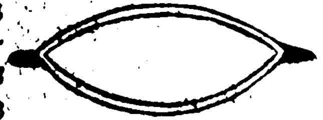
The wind, according to Ariſtotle, is an exhalation hot and dry, engendred in the bowels of the earth, and being gotten out, is carried ſidelong vpon the face of the earth. And of winds there be foure principall, which doe take their names from the foure quarters of the earth, from whence they blow, that is, North, South, Eaſt and Weſt: and though the Greekes and Latines diuide euery quarter into three parts, and thereby make in all but twelue windes, whoſe names both Greeke and Latine are ſet downe in the latter end of my Spheare, yet our latter Sea-men to be the more aſſured of their Routes and Courſes, doe diuide euery quarter of the Horizon into eight windes, ſo as in all they make 32. winds, giuing them ſuch names as are ſet downe in this figure here following, repreſenting the Fly of the Marriners compaſſe.



CHAP. XXIIII.

A briefe diſcription of the Marriners compaſſe, and the vſe thereof.

THe Mariners compaſſe may be very wel diuided into 2. eſſentiall parts, that is, the Fly, and the wyars, touched with the Ladeſtone, called in Latine Magnes. And firſt you haue to vnderſtand, that the Fly is a round white Carde, fraſed with 32. lines all paſſing through the Centre of the Circle, which lines doe ſignifie the 32. winds, in ſuch ſort as the figure before ſet downe doth ſhew, of which lines, that which is marked with the Flower-deluce ſignifieth the North, whoſe point oppoſite is the South, and that which is marked with a Croſſe ſignifieth the Eaſt, whoſe point oppoſite is the Weſt, and the vttermoſt Circle of the ſaid Fly ſignifieth the Horizon, which Circle is alſo diuided into 360. degrees, like to thoſe of the Equinoctiall, ſo as euery ſpace betwixt point and point, containeth 11. degrees, and 15. minutes, which is the fourth part of a degree. Moreouer, this Circle is diuided into 24. houres by allowing to euery point three quarters of an houre, which is 45. minutes, for an houre containeth 60^{m}. and halfe an houre containeth 30^{m}. and the quarter 15^{m}. Moreouer the common Marriners doe diuide euery point of the compaſſe into foure quarters, to make the more exact account of their Routes or Rombes. But now as touching the other eſſentiall part of the Marriners Compaſſe, which is the wyars, you ſhall vnderſtand that they are of yron or ſteele, and made in this forme, and being touched at the one ende with the Lodeſtone, they are faſtned to the backe-ſide of the Fly, either right vnder the line marked with the Flower-deluce, or elſe ſomewhat diſtant from the North, either towards the Eaſt or elſe towards the Weſt, for ſuch cauſe as ſhall be declared in the next Chapter, for thoſe wyars being thus touched, doe make that part of the Fly that is marked with the Flower-deluce, to ſtand alwaies towards the North, and to



that

that end the Fly hauing in the Centre a latten ſocket, is put into a turned boxe, in the middeſt whereof is a ſharpe pointed Latten pinne, vpon which the Fly turneth about, and that turned boxe is couered with glaſſe, partly to kéepe the Fly cleane, but chiefly that the wind ſhould not moue it too and fro. And this turned boxe is hanged by two round narrow plates of Latten, in another ſquare boxe of thinne wainſcot boord, ſo as it may alwaies hang leuell, howſoeuer the ſhippe ſwayeth or inclineth on either ſide, and though of the Mariners compaſſe there be diuers vſes, as you ſhall perceiue hereafter, yet the chiefeſt end and vſe thereof is to ſhew the North part of the world, whereby the Shipmaſter knowing what courſe he hath to hold, and how the port or place to which he goeth, beareth from the place from which he departeth, may by looking alwaies to his Compaſſe, know how to direct his ſhip accordingly.

CHAP. XXV.

Of the Loadſtone, and of the variation of the Compaſſe in Northeaſting and Northweſting.

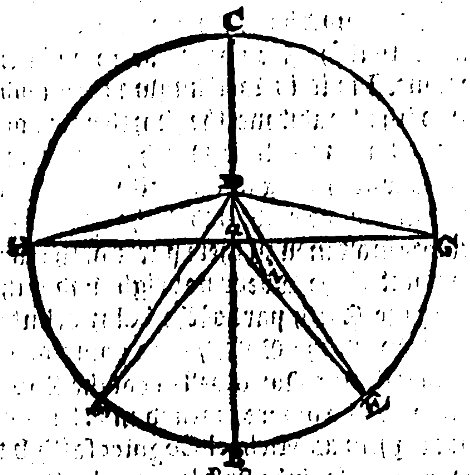
THe Loadſtone or Adamant, called in Latine Magnes, and in Italian Calamita, hath two maruellous great and ſecret properties or vertues, the one to draw ſtéele or Iron vnto it, and the other to ſhew the North and South part of the world, of which ſtones ſome be of more force then others, according to the place from whence they come. For thoſe are counted beſt which are found in the Eaſt Indies vpon the Coaſt of China, and Bengala, which is no ſhell but a whole ſtone of ſanguine Colour like to Iron, and is firme, maſſy, and heauy, and will draw or lift vp the iuſt waight of it ſelfe in Iron or ſtéele. And as Norman ſaith in his new Attractiue, ſuch ſtones are commonly ſold for their waight in ſiluer.

Next to this, Norman commendeth the red ſtone of Arabia, he commendeth alſo the ſtone of Almayne, which is in colour like to Iron, but ſpungeous, and thereby lighter then the other. And

as for the black and white ſtone of Elba, which is an Iland, not farre from Plombino, he ſaith the vertue thereof is but of ſmall force and of no long continuance. But the worſt are thoſe that come from Norway, whoſe colour is mixt with gray. I haue heard that there be of them here in England, but how good I know not; it is maruell that Norman maketh no mention thereof, whoſe Treatiſe called the new Attractiue, together with M. Borough his addition, I would wiſh all that be ſtudious in this Art to read moſt diligently; for truly in mine opiniō the ſecrets of this Stone and variation of the Compaſſe, was neuer better diſciphered, nor by more experiences tryed then it hath béene by theſe two men laſt named. The Booke is moſt neceſſary for Nauigation and of an eaſie price, meete for euery poore mans purſe, though perhaps, in ſome points, not méet for euery mans vnderſtanding. Now whenſoeuer the wyars are to bee touched with this ſtone, they muſt be made very cleane and voyd of all ruſt, to the intent that the Iron may the more firmely receiue yͤ vertue of the ſtone. And it is well knowne by good experience, that by vertue of the Loadſtone, the North point of the Cōpaſſe, declineth alwayes from the true North, eyther to the Eaſt, or Weſt, more or leſſe according to the latitude of the place wherein you are, vnleſſe you be right vnder the Meridian of the Azores. And therefore moſt men in theſe parts of the world, do vſe to ſet the North point of the wyers not right vnder the Flower de Luce, ſignifying the North part of the World, but rather ſomewhat inclining toward the Eaſt, halfe a point or thereabout to auoid the Northeaſting & Northweſting of the Cōpaſſe, the cauſe of which declination by diuers learned men hath béene diuerſly taught, but not rightly as Michael Cogniet ſaith, vntill Mercator found out the true cauſe, who firſt learned by the experience of one Francis of Deep, an excellent Pilot, that in ſayling vnder the Meridian which paſſeth through the Iles called the Azores, the néedle doth decline neyther Eaſt nor Weſt, whereupon Mercator by calculating the variation of the Compaſſe at Ratisbone, ſaith that the Pole of the Loadſtone ought to be put in that Meridian which paſſeth through the foreſayd Iles, ſo as it may be diſtant frō the Pole of the world 16. deg. or rather as M. Borough ſaith

ſix

ſixtéene degrées and twenty two minutes, and by that calculation, Cogniet hath found the variation of the Compaſſe at the Towne of Antwerp, to bee 9. degrées. And M. Borough by the new Inſtrument of variation firſt made by Robert Norman, & afterward perfected by himſelfe, haue found the variation for London, to be 11. degrées and fiftéene minutes, which is a whole point from North to Eaſt. But whenſoeuer you depart from the foreſaid Meridian of the Azores, be it neuer ſo little, eyther toward the Eaſt or Weſt, the Néedle will vary and decline accordingly. And his greateſt declination is when you come to a full quarter of that Parallel wherein you ſayle, for from thence it declineth leſſe and leſſe, vntill you come againe vnder the foreſaid Meridian, which thing Cognien doth plainly demonſtrate, by this Figure here made of purpoſe.



In this figure the letter A, which is in the very centre of the Circle of the North Pole, and the right Line marked with the letters C.B. ſignifieth the Meridian which paſſeth through the Iles Azores, in which line is a point or pricke marked with the letter D. ſignifying the Pole of the Loadſtone, diſtant from the North Pole ſixtéene degrées and a halfe. Now, if your ſhip be in the point B. then your néedle declineth on neither ſide, but point-

eth

eth right to the North Pole, and alſo to the Pole of the Loadſtone. But if you ſaile Eaſtward and arriue to the point E. then the right line of the North is E. A. but your néedle declineth on the right hand towards his owne Pole D. which is to the Eaſt, ſo much as the Angle A.E.D. doth ſhew, Likewiſe if you ſaile from B. Weſtward to the point F. the right line of the North, ſhal be F.A. but your néedle will decline to his own Pole D. towards the Weſt, ſo much as the Angle A.F.D. doth ſhew, And to bee ſhort, the néedle doth neuer ſhew the right North, but onely in C. or B. to either of which points the nigher that you approach, the leſſe your néedle declineth, and the more that you go from any of theſe two points, the more your néedle declineth either Eaſt or Weſt, but the greateſt declination thereof is in H. or G. for then you are a iuſt quarter from the foreſaid Meridian. Alſo by this Figure, he plainly ſheweth that of two ſundry Townes hauing one ſelfe Meridian, that which is néereſt to the Pole of the world hath greateſt declination. As for example, ſuppoſe the letter I. in the foreſaid Figure to ſignifie that Towne which is nigher to the Pole and the letter E. to ſignifie that Towne which is more diſtant from the Pole, both Townes being vnder one ſelfe Meridian E.A. Heare you ſée that the Néedle being in E. doth ſhew the Pole, of the Loadſtone by the line E.D. and being in I. it ſheweth the Pole of the Loadſtone by the line I.D. Now according to the doctrine of Euclyde, the Angle A.I.D. is greater then the Angle A.E.D. whereby it followeth that the Néedle declineth more in I. then in E. But whereas Mercator affirmeth that there ſhould be a mine or great rocke of Adamant, whereunto all other leſſer rockes or Néedles touched with the Loadſtone, doe incline as to their chiefe fountain, that opinion ſéemeth to me very ſtrange for truly I rather beléeue with Robert Norman that the properties of the Stone, as well in drawing ſteele, as in ſhewing the North Pole; are ſecret vertues giuen of G O D, to that ſtone for mans neceſſary vſe and behoofe, of which ſecret vertues no man is able to ſhew the true cauſe.

How

CHAP. XXVI.

How to find out the variation of the Compaſſe in euery Latitude.

William Borne in his Regiment of yͤ Sea, teacheth diuers waies, how to finde out the variation of the Compaſſe, as well by the Sunne in the day time, as by the North ſtarre in the night ſeaſon. Firſt, thus marke at what point of the Compaſſe, the Sunne riſeth and ſetteth, for if it riſeth at the Eaſt point of the Compaſſe, and goeth downe at the Weſt Northweſt point, then the Compaſſe is varied one whole point, that is to ſay, the North point of the Compaſſe ſtandeth North and by Eaſt. But becauſe the Aire is ſeldome cleare at the riſing and ſetting of the Sunne, you may doe thus, take with your Aſtrolabe or Croſſe ſtaffe the Altitude of the Sunne in the forenoone, the ſooner the better, at ſome iuſt point of the Compaſſe, and take againe his altitude in the afternoone, when he is in like degrée of altitude, and marke therewith at what point of the compaſſe, the Sunne hath ſuch Altitude, and by the difference thereof you ſhall know the variation of the Compaſſe. As for example, you finde by your Aſtrolabe or Croſſe ſtaffe, that the Sunne is 20. degrées high at the Southeaſt point of the compaſſe, and obſeruing the ſame againe in the afternoone, you find his height to be 20. degrées, at the Weſt Southweſt point of the Compaſſe, whereby you ſée that the Compaſſe is varied one whole point, that is to ſay, that the North point ſtandeth North and by Eaſt, and the South point, is South and by Weſt. Hee teacheth it alſo another way, which is thus.

Take with your Croſſe ſtaffe, or Aſtrolabe, the height of the Sun at noone-tide, which is called the Meridian altitude of the Sunne, and therby you ſhal haue the true Meridian of the place where you are, with which Meridian if the South point of your Compaſſe doth agrée, then your Compaſſe hath no variation at all, but if the South point thereof doe ſwarue or incline on either ſide from the Meridian, marke how much it differeth, and

that difference will ſhew you the variation. Now to know the variation of the Compaſſe, by the North ſtarre, doe thus, ſet your Compaſſe with the North ſtarre, and if you finde them ſo agrée, then there is no variation, but note that this is to be done when the two guards or pointers of Charles Waine, are right ouer or right vnder the North ſtarre, for if theſe two ſtarres bée Weſt from the Northſtarre, then the Northſtar is a third part of a point vnto the Eaſtward of the North Pole, and if the ſaid two ſtarres be right Eaſt from the North ſtar, then the North ſtar is a third part of a point vnto the Weſtward of the North Pole.

The Compaſſe (as Boorne ſaith) doth vary moſt in ſayling long voyages Eaſt and Weſt, and though it varieth two or thrée points, yet you may know what courſe to hold without alteration of the wyers any maner of way. As for example, ſuppoſe the Northeaſt point to ſtand right North, and your courſe is to goe right Weſt, héere in this caſe you may vſe the South weſt point in ſtéed of the weſt point, wherby you may perceiue, that it maketh no great matter, which point ſtandeth due North, ſo as you take that point of the Compaſſe for the North, which directly pointeth to the North. But Robert Norman and M. Borough, by the helpe of their new inuented Inſtrument of variation, do ſhew how to finde out the variation of the Compaſſe, much more exactly then euer it hath béene héeretofore taught, which inſtrument together with the book, I would wiſh al Sea-men to haue, and therby to learn the perfect vſe of the Inſtrument, which vſe that Book teacheth both plainly and learnedly, in which Booke is alſo prooued by diuers demonſtrations, that there is no ſuch attractiue point as ſome haue dreamed, but rather a reſpectiue point whereunto the néedle of your Compaſſe wil alwaies turn in what part of yͤ world ſoeuer you ſaile. But of the place where that reſpectiue point ſhould be, diuers learned Pilots haue had diuers opinions, for ſome haue imagined it to be in the heauens and ſome aboue the heauens, if it were in the heauens, then the néedle would daily turne about, and alter according to the motion of the heauen, wherein the ſaid point is, which is nothing ſo, And to be aboue the heauens, it is contrary to yͤ old rule of Philoſophy.

loſophy, which ſaith that Extra Cœlum non eſt locus, and therefore Norman and Maſter Borough haue great reaſon to ſay that it is in the body of the Earth beneath the Horizon, for they haue tryed by diuers liuely experiments, that the North part of the Needle of his owne accord, and nature would alwayes decline downward if it be not otherwiſe counterpoiſed or letted, and by their demonſtrations ſuppoſing the Meridian of the Azores, to be the firſt or common Meridian, and alſo knowing the altitude of the Pole at London to be 51. degrees 32. minutes, they finde that according to that latitude the Pole of the Loadſtone being in the vpper face of the Earth, and right vnder the foreſaid common Meridian, is 25. degrees 44. minutes, diſtant from the Pole of the World. And the point reſpectiue to bee diſtant in a right line from vnder the Horizon of London 75. degrees 50. minutes, and the variation of the Compaſſe to be as hath beene ſayd before, 11. degrees and 15. minutes, but to finde out the true place of the reſpectiue point in euery Latitude, they ſay, that no certaine rules can as yet be ſet downe, by reaſon that the Compaſſe doth vary more ſuddainly in one place then in another, for in ſome place it will vary more in ſayling 200. leagues, then in another place in ſayling 400. leagues. Againe, it will ſometimes be retrograde, for Maſter Borough in ſayling betwixt the North Cape and Vaigates towards the Northeaſt, and looking by his computation that the Needle ſhould haue increaſed his variation towards the Eaſt, he found that it was ſuddenly turned backward toward the Weſt, notwithſtanding both Norman and M. Borough do affirme, that though the Compaſſe hath in ſeuerall Horizons ſeuerall variations, yet in any one Horizon the Needle alwayes reſpecteth one onely point, without alteration, and that in his declining it keepeth the like order, and that certainly in euery place. And although the Needle of the Cõpaſſe by reaſon of the weightineſſe of the Fly cannot decline downward according to his owne propertie, but onely ſheweth the point reſpectiue alwayes vpon the Horizon, which indeed, as they ſay, is moſt neceſſary for Nauigation, yet by ſuch meanes and concluſions as are ſet downe in the foreſaid Booke, a diligent Pilot hauing with him a perfect ſtone, may by exact obſeruations

finde out the increaſing or decreaſing of the declination of the Needle, which declination you ſhall finde, as they thinke to bee more or leſſe, according as the point reſpectiue is more or leſſe, diſtant from the place whereas the triall is made, which being diligently obſerued in ſundry places, with the certaine variation of the Needle from the Meridian, the true place of the point reſpectiue may be found out as they thinke.

But there be three cauſes which moue me to think, that the reſpectiue point will neuer bee truly found out. Firſt, for that the Meridian, which in theſe daies is ſuppoſed to bee the firſt Meridian paſſing through the Azores, eſpecially through the Iles S. Marie, and Saint Michael. Is not that Meridian vnder which the Mariners compaſſe doth rightly point, as well vnto the pole of the Loadſtone, as alſo to the North Pole of the world, for though Frances of Deepe found it ſo by his Compaſſe, yet diuers learned Pylots ſince his time hauing ſailed vnder yͤ Meridian, haue found the variation of their compaſſe to be as much there, as elſe where, and not rightly to point to the reſpectiue point, which is ſuppoſed to be vpon the earth, and without ſuch a certaine Meridian, no true account from any Latitude can be made. The ſecond cauſe which moueth me to thinke as before, is for that the Compaſſe in ſome place of the Sea, will be ſuddenly retrograde, which thing Maſter Bourough by his own experience affirmeth to be true, as is before ſet downe. The third cauſe is, for that I doe verily beleeue, the finding out of the true place of the reſpectiue point, to be as great a ſecret in nature, as it is to know the cauſe why the Loadſtone ſhould haue ſuch vertue to draw Steele vnto it, and to ſhew the North Pole of the world, which are two ſecret gifts giuen to that ſtone of God, for mans behoofe, and yet the cauſe thereof is not to be found out by man, though moſt carefully ſought by the greateſt Phyloſophers that euer were.

CHAP. XXVII.

Of the Mariners Carde, and of the making thereof.

THe Marriners Carde, which ſome call a Nauticall Planiſphere, is none other thing but a deſcription made in Plano vpon paper or parchment, of the places that be in the ſea, or in the land next adioyning to the Sea, as Points, Capes, Bayes, Ports, Floods, Ilands, Rockes, Sands, and ſuch like: And ſuch Cardes are either vniuerſall or particular: the vniuerſall Cards are thoſe wherein are deſcribed the moſt parts of the world, ſuch as is the vniuerſall Carde or Map of Mercator, or of Plancius: The particulars are thoſe wherein ſome ſpeciall parts of the ſea and land are deſcribed. And both theſe kinds of Cards, are traced with certaine lines, whereof ſome are called Meridians, ſome Parallels, and ſome the Lines of the Marriners Compaſſe, ſhewing the 32. winds before deſcribed, in the beginning of this Treatiſe. The order of making which Cards in times paſt was woont to be thus.

Firſt, draw with a paire of compaſſes a ſecret circle that may be put out, ſo great as you ſhall thinke meet for your card, which circle ſhall ſignifie the Horizon, then diuide that circle into foure equall quarters, by Drawing two Diameters croſſing one another, in the Centre of the foreſaide Circle with right Angles; whereof the perpendicular line is the line of the North & South, and the other croſſing the ſame is the line of the Eaſt & Weſt, at the foure ends of which croſſe Diameters, you muſt ſet downe the foure principall winds, that is, Eaſt, Weſt, North, & South, marking the North part with a Flower-deluce in the top, and the Eaſt part with a croſſe, as you may ſee in the Figure following. Then diuide euery quarter of the ſayd Circle with your Compaſſes into two equall parts, ſetting downe prickes, in the middeſt of euery quarter, through which prickes, & alſo through the Centre of the Circle, draw two other croſſe lines, which muſt extend ſomewhat beyond the circumference of yͤ Horizon, which two croſſe lines together with the firſt two croſſe lines ſhall diuide the Circle into 8. parts, and therby you ſhall haue the eight principall winds. That done, diuide euery 8. part of the ſaid Horizon into two equall parts by drawing other two croſſe lines through the Centre, and extending ſomewhat beyond the circumference of the Horizon as before, whereby the whole Circle ſhall be diuided into 16. parts, which ſhall ſuffice without making any more diuiſions, which would cauſe a confuſion of lines and at the end of euery one of theſe 16. lines you muſt draw a little circle, whoſe centre muſt ſtand vpon the circumference of the Horizon, euery one whereof muſt be alſo diuided into 16. parts by helpe of the 16. lines, diuerſly drawne from the Centre of one little Circle to another, in ſuch order as the figure heere placed more plainly ſheweth to the eye, then I can expreſſe the ſame by mouth. And theſe little circles do ſignifie 16. little Marines compaſſes, the lines whereof ſignifying the winds, do ſhew how one place beareth from another, and by what wind the ſhip hath to ſaile. But beſides thoſe little circles, there is wont to be drawne alſo another circle, ſomewhat greater then the reſt vpon the very centre of the Horizon, which circle by reaſon of the 16. lines that were firſt drawne paſſing through the ſame, is diuided into 16. parts, and the Mariners doe call this Circle the mother Compaſſe.

Here place the Mariners Carde.

CHAP. XXVIII.

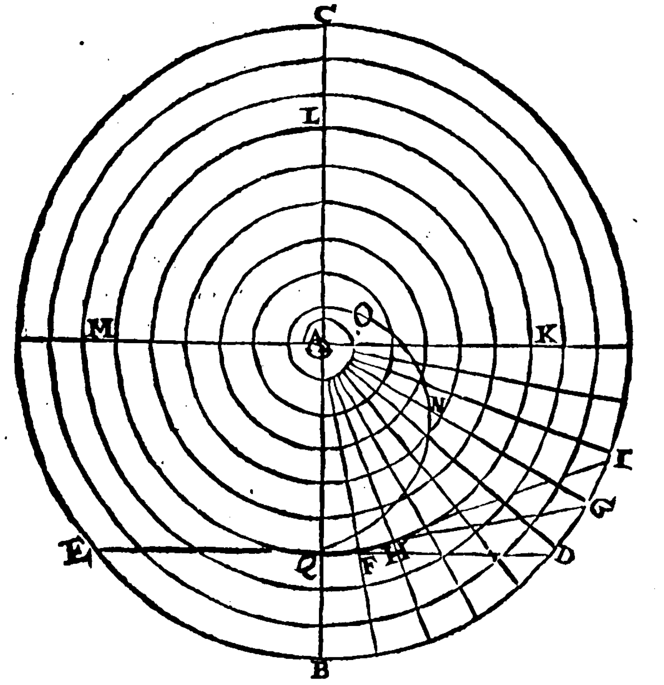
The ſhape and figure of the firſt lineaments of the Marriners Carde, drawne after the old manner, and how to ſet downe the places of the land or Sea therein.

NOw the true ſetting downe of the places in the Mariners Carde, as Points, Capes, Bayes, Floods, Ilands, and ſuch like, is to be done, by knowing what latitude and longitude euery place hath which is to be learned, either by moderne Tables made of purpoſe: for the Ancient tables make no mention of any Longitudes or Latitudes of ſuch places as are in the newe found Land, which Land to them was neuer knowne, or elſe by ſuch Mariners Cards already made, as do ſhew the true Longitudes and Latitude of thoſe places, which you would deſcribe in your Carde; of which Longitudes and Latitudes, and eſpecially, the Longitudes of the places in the Weſt Indies, few or none as are yet truely ſet downe.

Moreouer, to know the diſtance of places, that is, how many leagues or miles one place is diſtant from another, there is wont to be ſet downe in the Mariners Carde, a ſcale, otherwiſe called by the Mariners a Trunke, the making whereof is plainly taught by Martin Cortes in his Art of Nauigation, in the ſecond Chapter of his third booke, and alſo how to graduate the Cardes, to ſhew what Latitude euery place hath, and there alſo he teacheth how to tranſlate one Carde to another; and how to reduce a greater Carde into a leſſer, & contrariwiſe. To which booke I referre you, and the rather for that it is in Engliſh, tranſlated many yeres ſince, out of Spaniſh by M. Richard Eden.

But for as much as the Seas and the earth do make together one whole round body, the lines of the 32. rombes in the Carde, being drawne right, & made the ſignes great circles, can neuer ſhew ỳ true courſe that ỳ ſhip hath to hold, which Michael Cognit prooueth by a figure demonſtratiue, & thereof gathereth thre concluſions. Firſt, that a man may ſaile right North and South round about the world, if the Sea in all that courſe be Nauigable, and ſo returne againe to the Port from whence he firſt departed. Secondly, that making the Equinoctiall his Parallel, he may ſaile Eaſt and Weſt round about the world, and ſo returne to the Port from whence he departed. Alſo if he ſaile Eaſt and Weſt in any other Parallel, that is diſtant from the Equinoctiall, he may returne by the ſame Parallel to the Port from whence he firſt departed, and yet not about the whole world, for that cannot be done, but onely when the Equinoctiall is his Parallel. Thirdly, that whoſoeuer ſaileth by any other rombe then by one of the foure principall, he by often changing his Meridian and Horizon muſt néeds ſaile by a line Spirall, which is neither perfectly right, nor perfectly round, and thereby he may well approach

the Pole, and alſo goe round about it, but yet with vnequal diſtance, ſo as he ſhall be nigher beyond it then on this ſide, by meanes whereof he cannot returne to the place from whence he came, as you may plainly perceiue by this Figure demonſtratiue héere placed.

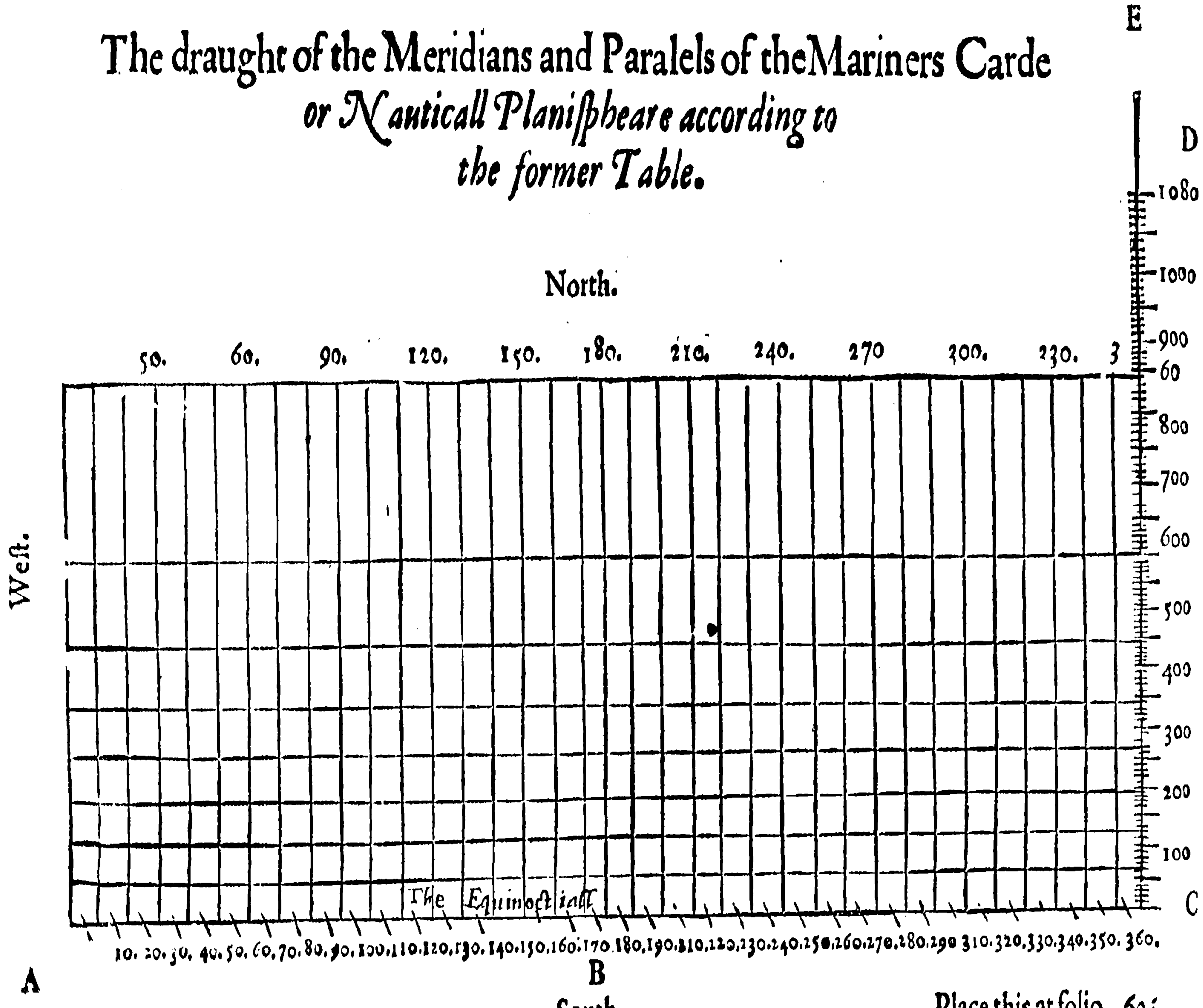


In which Figure the Letter A. doth ſignifie the North Pole, and the Letters B.C. the Meridian paſſing through the Pole A. then ſuppoſe your ſhip to be in Q. whereas the Pole is eleuated 30. degrées, and Q. to be your Zenith, & the right line E.Q.D. to be your right line of Eaſt and Weſt, cutting the foreſaid Meridian with right Angles, and let D. be the Eaſt point, and E. the Weſt point.

Now you may ſayle from Q. towards the North with a South Wind, and from A. you may ſayle againe Southward with a North winde vntill you come to the South Pole, and from thence you may ſaile againe Northward with a South winde, vntill you come againe to Q. from whence you firſt departed, and ſo you ſhall haue gone round about the world vnder one ſelfe Meridian B.A.C. But in ſailing Eaſt, or Weſt, you ſhall continually change your Meridian, and thereby change your Eaſt point, for in ſailing from Q. towards D. you come immediately to the Meridian A.F. whoſe right Eaſt point is G. and in ſailing farther Eaſtward, you come to the Meridian A.H. whoſe right Eaſtpoint is I. and ſo forth, from one Meridian to another, notwithſtanding in kéeping ſtill in one ſelfe Parallel marked with K. L. M. you may ſaile round about the Pole A. which is the Center, and ſo come againe to the Port Q. from whence you firſt departed, but not about the whole world: for that you cannot doe vnleſſe the Equinoctiall were your Parallel, as hath béene ſaid before, but if you ſaile by any other rombe, then by one of the foure principall, that is, Eaſt, Weſt, North, or South, your courſe ſhall neither be by right line, nor yet by true Circle, but by a ſpirall line, which is partly right, and partly rounde, ſo as you cannot with like courſe returne, to the place from whence you departed, by reaſon ẏ you change ſo often both Meridian and Horizon, as by the Spirall line, Q.N. O. drawne in this figure you may eaſily perceiue, which approcheth nigher to the Pole beyond it then on this ſide. Moreouer the Sea-men, by making the Meridians, and Parallels in their Cardes all of equall diſtance, they make ſome Countries farre greater then they ſhould be by the one halfe. Alſo by that meanes, hee that ſaileth Eaſt and Weſt, round about the Pole, in the Parallel whoſe latitude is 60. degrées, ſhould make as long a voyage as he that ſaileth Eaſt and Weſt, alongſt the Equinoctiall, the voyage whereof is twiſe as long as the other, for the redreſſe and remedy of which faults, Cogniet hopeth to find out ſome more perfect rule of making cards, when opportunity of time ſhall ſerue: in the meane time to reforme the ſaid faults, Mercator hath in his vniuerſall Card or Map, made the ſpaces of the Parallels of Latitude to bee wider, euery one then other from the Equinoctial towards either of the Poles, by what rule

I

The draught of the Meridians and Paralels of the Mariners Carde *or Nauticall Planiſpheare according to the former Table.*



Place this at folio, 695.

I know not vnleſſe it be by ſuch a Table, as my friend Maſter Wright of Caius Colledge in Cambridge, at my requeſt ſent me (I thanke him) not long ſince, for that purpoſe, which Table with his conſent, I haue heere plainely ſet downe together with the vſe thereof, as followeth.

Heere muſt you place the Draught of the Meridians, and Parallels of the Marriners Carde,

CHAP. XXIX.

A Table to draw therby the Parallels in the Mariners Card, together with the vſe thereof in trewer ſort then they haue beene drawne heretofore, and the vſe thereof.

Degrees of the Meridian beginning from the Equinoctiall circle.	Equall parts of the Meridian in the Mariners card of which parts euery degree of the Equinoctiall containeth 60. miles.	Degrees of the Meridian beginning at the Equinoctiall circle.	Equall parts of the Meridian in the Marriners card of which parts euery degree of the Equinoctiall containeth 60. miles.
1	60	27	1684
2	120	28	1752
3	180	29	1820
4	240	30	1889
5	300	31	1959
6	361	32	2029
7	421	33	2100
8	482	34	2173
9	542	35	2245
10	603	36	2319
11	664	37	2394
12	725	38	2470
13	787	39	3546
14	849	40	2624
15	911	41	2703
16	973	42	2783
17	1035	43	2865
18	1098	44	2948
19	1162	45	3032
20	1225	46	3118
21	1289	47	3205
22	1354	48	3294
23	1419	49	3385
24	1484	50	3477
25	1551	51	3572
26	1617	52	3668

Degrees of the Meridian,&c.	Equall partes of the Meridian,&c.	Degrees of the Meridian,&c.	Equall parts of the Meridian,&c.
53	3767	67	5482
54	3868	68	5639
55	3972	69	5804
56	4078	70	5976
57	4187	71	6156
58	4299	72	6346
59	4414	73	6547
60	4532	74	6759
61	4655	75	6985
62	4781	76	6226
63	4911	77	7484
64	5046	78	7764
65	5189	79	8067
66	5331	80	8399.

The vſe of this Table for making the Sea Carde is thus. Ouerthwart the middeſt of the Plaine ſuperficies, wherein you would draw the lineaments of the Carde, deſcribe a right line marked with the letters A. B. C. whereof B. is the very middeſt or Centre, and this line repreſenteth the Equinoctiall; the end whereof on the right hand marked with the letter C. ſignifieth the Eaſt, and the other end on the left hand marked with the letter A. ſignifieth the Weſt, which Equinoctiall line, muſt be diuided into 360. degrees, then croſſe the ſame ſquirewiſe with perpendicular lines, paſſing through euery tenth or fifth degres, as you ſee in the example following. Then take with your compaſſes, the length of halfe the Equinoctiall, that is, 180. degrées, and ſet one foote of your Compaſſes in the mutuall interſection of the Equinoctiall, and of that perpendicular or Meridian, which paſſeth through the Eaſt end of the Equinoctiall line, marked with the letter C. and with the other foote make a pricke in the ſame perpendicular or Meridian, and marke that pricke with the letter D. that done, diuide the ſpace contained betwixt this pricke and the Equinoctiall, firſt into three equall parts; & euery one of thoſe into other three equall parts, ſo haue you 9. parts. And againe euery one of thoſe into three, ſo haue you twenty ſeuen parts, & diuide euery one of thoſe parts into foure parts, ſo ſhal you haue a hundred and eight parts, and if their be ſpace enough, diuide againe euery one of thoſe into tenne, ſo ſhall you haue 1080. parts, and if it be poſſible, diuide againe euery one of thoſe parts into other tenne, ſo ſhall you in all 10/800. parts, but this can hardly bee done, vnleſſe the card be very large, wherein euery degree of the Equinoctial is neere an inch long, which hapneth very ſeldome, and therefore 1080, parts ſhall ſuffice.

And for the eaſier numbring of theſe parts, ſet to them Arithmeticall figures with blacke lead, which may afterward be put out when your work is done, beginning at the Equinoctiall, and ſo proceede from thence both Northward and Southward, then look what number ſtandeth right againſt euery degree in the former Table, which degrees do extend from one to foureſcore degrees, and omitting alwaies the firſt figure on the right hand of that number which you find, for ſo you muſt alwaies doe when your diuiſion containeth no more but 1080. parts, count that number which remaineth vpon the line of diuiſion, & there make one pricke, & make an other pricke of the ſame diſtance from the Equinoctiall vpon the vttermoſt Meridian on the left hand, through which two prickes draw a right line, and that ſhall bee your firſt Parallel of latitude, and ſo proceede with all the reſt, firſt Northward, and then Southward, if you minde to make an vniuerſall Carde. But the example following, containeth no more but the one halfe of an vniuerſall Carde, proceeding from the Equinoctiall line Northward, vnto the 80. degrees of Latitude: for farther Northward: then 80. degrees is no land as yet diſcouered or knowne, nor yet all that, ſo farre as euer I could learne.

CHAP. XXX.

The draught of the Meridians and Parallels of the Mariners Carde, or Nauticall Planiſpheare, according to the former Table.

IN this laſt figure or Table is firſt drawne (as you ſee) the Equinoctial line marked with the letters A.B.C. and that line is diuided into 360. degrees, and therein alſo are drawne perpendicular lines, as well through the beginning and ending of the ſaid Equinoctiall line, as alſo through euery tenth degree thereof, which be the Meridians, and are euery where equidiſtant each one from other, then take halfe the length of the Equinoctiall, which is A.B. or F.C. with your Compaſſes, and ſetting one foot in the end of the Equinoctiall, marked with C. make with the other foote a pricke at D. in the Meridian or perpendicular line marked with the letters C.D.E. then diuide the ſpace contayned betwixt C. and D. into 1080. parts, in ſuch ſort as before hath beene ſhewed, and ſet the Figures vnto them, as heere you ſee, to the intent that you may the more readily number the parts. Then look in the firſt table what number anſwereth to euery 10. degree of yͤ Equinoctiall, and caſting away the firſt Figure of that number on the right hand, finde out the parts anſwerable to the number remayning in the line C.D. and at thoſe parts ſet prickes in both the outward Meridians, through which prickes you ſhall draw the Parallels. As for example, in the firſt Table you ſee that the number right againſt 10. degrees is 60. (the firſt figure 3. towards the right hand being relected) therefore looke 60. in the line C.D. and by that part draw the firſt Parallel diſtant 10. degrees from the Equinoctiall. And after this maner all the reſt of the Parallels are to be drawne.

Many doe vſe to paint the vacant places in their Cards with ouer many flags, and the compaſſes thereof with diuerſe and ſuperfluous, colours, which William Bourne miſliked, wiſhing that in ſtead thereof, they would ſhew by letters or other characters what Moon doth make a full Sea, in ſuch places as are neceſſary to be knowne, and alſo to draw the true ſhape and faſhion of euery Cape or Head-land, that is needfull about yͤ Coaſt, and at what point of the compaſſe the land riſeth of this or that faſhion, for being neere the land it will ſeeme to bee of one faſhion, and being farre off to be of another faſhion, and to miſtake any place on the Sea is very dangerous to the Mariner. But aboue all things let him that ſayleth by Card and Compaſſe, be ſure that the Needle of his Compaſſe haue the like declination that his Needle had, which made the Card. For Cogniet reporteth that certaine Mariners, being in the Weſt Indies, and ſeeing the North ſtarre to be Northeaſt, maruelled thereat verie much, not knowing the cauſe of that errour, which indeed was for that yͤ Needle of their compaſſe was made to decline Northeaſt, whereas it ſhould rather haue declined North-weſt, for the Weſt Indies doe ſtand Weſternly from the Azores. It is neceſſary alſo to ſet downe in the Card ſuch places as are dangerous, as Sands, Flats Shoulds, Rocks, and ſuch like things as are not alwayes to be ſeene with the eye, to the intent that the Mariner being aduertiſed thereof, may ſhunne the ſame. All which things before mentioned, Wagoner hath in all places, contayned in his Booke, very well obſerued. Thus hauing ſpoken ſufficiently of making the Mariners Card now I thinke it good to ſhew the moſt neceſſarie and chiefeſt vſes thereof.

CHAP. XXXI.

The chiefeſt vſes of the Mariners Card.

THe chiefeſt vſes of the Sea Card are theſe foure here following.

The firſt is to know thereby how that place whereunto you would ſayle, beareth from the place or Port from whence you ſet off, or depart. And that is to be knowne by the lines of the Mariners Compaſſes, drawne in the Card, in this manner following: Take a paire of Compaſſes, & hauing opened them, ſet the one foot thereof in the very place from whence you depart, and the other foot in the next line of that Compaſſe, which is neareſt vnto your place of departing, I meane ſuch a line as doth moſt rightly direct you to the place to which you would goe, and your Compaſſe being opened at the fit wideneſſe to ſerue that line, draw them from the place of your departing, vnto the place whereunto you would goe, ſuffering the foot of the Compaſſe, which ſtandeth vpon the line of the wind, whileſt you draw it forward, not to ſwerue one iot from that line, and that line will either rightly direct you to the place aſſigned, or fall ſhort thereof, or elſe ouer-reach the ſame if it fall ſhort, then take another line neare to the place from which you departed, and if it ouer-reach, take ſome line that is further off from the place of your departing, & hauing found a line that pointeth directly to the place, conſider what wind or rombe it is, for by that wind the place aſſigned beareth from you, and the rombe or wind oppoſite to that is the wind, whereby you haue to ſaile.

The ſecond vſe is to know by the Card, how farre the place wherto you go is diſtant from the place of your departing, which is done by help of the ſcale or trunke ſet down in the Card, thus: Take the iuſt diſtance betwixt the two places with your compaſſes, by ſetting the one foot in the one place, and the other foot in the other place, and apply that widenſſe of the compaſſe to the ſcale or trunke, and the trunke wil ſhew how many leagues the one place is diſtant from the other, & if the diſtance betwixt the places be longer then the trunke, then take firſt the length of the trunke with your Compaſſes, and looke how many times that is contained in the ſpace betwixt the two places, and if there do remaine any odde meaſure, then hauing taken that odde meaſure with your Compaſſes, by ſetting them at ſuch wideneſſe as is anſwerable to that odde meaſure, apply that wideneſſe to the firſt part of the trunke, ſo ſhall you know the iuſt meaſure of the whole. And this rule ſerueth to take the true diſtance of any other two places, whatſoeuer is ſet downe in the Card.

The third vſe is to know by the Card, what Latitude, or Altitude of the Pole, any place ſet downe in the Card hath, which is

done

done by helpe of the line of degrees of Latitude, otherwiſe called the Graduation of the Card, in this manner following. Set the one foot of your Compaſſes, in the very place whereof you would know the Latitude, and the other foot in ẏ line of Eaſt & Weſt, which is next vnto that place, and keeping that foot ſtill vpon that line, draw your Compaſſes forward, vntill you come to the line of degrees, and marke what degree of the ſaid line the foot of the Compaſſe, which was firſt ſet in the place, doth croſſe or touch, for that is the degree of Latitude for that place, numbring from the loweſt degree of Graduation vpward, ſo ſhall you find the Latitude of Lisborne in Portugal, by Mercator his vniuerſal Card, and by the Card ſet downe in Martin Cortes Booke, and alſo by Media his Card, drawne in his Booke of Nauigation, to be 38. degrees, 30. Minutes and ſomewhat more. But by the Tables of Ptolemie you ſhall find it to bee 40. Degrees, 24. Minutes, and by Appian his Tables to be 39. Degrees and 38. Minutes.

The fourth vſe chanceth when you are driuen out of your right courſe by ſtormes or tempeſt, which ſtormes how to foreſee and to prognoſticate, is plainly taught by Martin Cortes in the 19. Chapter of his ſecond Booke. Alſo you may bee driuen by force of contrary winds, by ſurging of the Sea, or by ouerthwart Tides, Currents, and ſuch like impediments, ſo as you cannot lay your courſe right to the place aſſigned, for remedy whereof you muſt ſeeke in what place you are, and to note the ſame in your Card, which as the Marriners terme it, is to make a prick in the Card, which to doe truly in time of neede, many things are to be knowen and well obſerued, and kept in memorie. Firſt, to know what Latitude the place from whence you firſt departed hath, then to keepe in minde what way your ſhip did make good at euery ſhift of wind, that is to ſay, how many leagues, and in how long time you ſailed by euery ſeuerall winde: and then not knowing well where you are, nor how farre you are diſtant from the place whereunto you would goe, learne to know by helpe of your Aſtrolabe or Croſſe-ſtaffe in ſuch ſort as is before taught, the altitude of the Pole in that place where you are, which if you find to be all one with the Latitude, of the place of

your

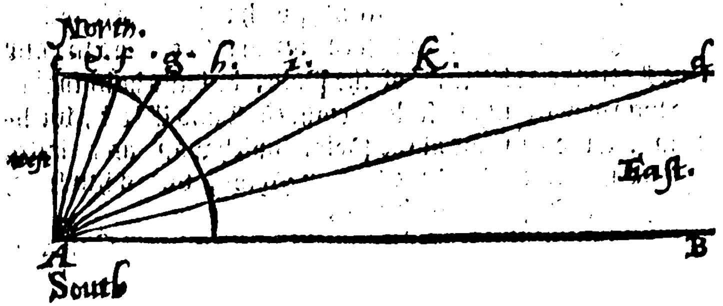
your departure, then you may aſſure your ſelfe that you haue ſailed by the line of Eaſt and Weſt without altering your Latitude, but if you find the Latitude of the place where you are, to be more or leſſe then the Latitude of the place from whence you departed, then reſort to your Card, and take two paire of Compaſſes, opened at ſuch wideneſſe as the one foot of the one Compaſſe may ſtand in the place from which you departed, and the other foot of the ſame Compaſſe to ſtand in the line of ẏ rombe, whereby you ſayled: and let the one foot of the other Compaſſe ſtand in that degree of Latitude which you laſt found, and the other foot of the ſame Compaſſe in the next line of Eaſt & Weſt, and holding the Compaſſes ſo ordered in each hand one payre: draw them both ſo as they may meet together, taking good heed in drawing them, that the foot of that compaſſe which was placed in the line of the wind, may at no time ſwerue from that line nor the one foot of the other Compaſſe to ſwerue from the line of Eaſt and Weſt, wherein it was firſt placed, and whereas the two feet of thoſe Compaſſes doe meete, that is to ſay, that foot of the one Compaſſe, which was drawne from the place of your departing, doe meet with that foot of the other Compaſſe, which came from the degree of Latitude laſt found, where theſe two feet (I ſay doe meet, there make a prick, or marke in your Card, for that is the place where your ſhip is at that inſtant. And from thence you muſt take your right courſe againe to the place whereunto you would goe. But becauſe it is neceſſary as well at this time as at all other times, to know what way your ſhip hath made, and that the ſame is not, in mine opinion, ſo plainly, nor ſo commodiouſly taught by any one that I haue read, as by Michael Cognier, I minde therefore in the two Chapters next following, to ſet downe his way, not only how to find out the way of your ſhip, when you ſaile South or North vnder one ſelfe Meridian, or in any other place where you are to change in your gate the Latitude or Altitude of the Pole, but alſo how to find out the way of your ſhip in ſailing right Eaſt and Weſt, without changing the Altitude of the Pole, which way, as he ſaith, was neuer heretofore knowne to any Pylot, but to himſelfe, firſt Authour and Inuenter thereof.

CHAP.

CHAP. XXXII.

How to know the way of your Ship, and how many Leagues are to be counted for one degree in Latitude of euery Rombe whereby you ſayle.

FIrſt, you haue to vnderſtand that in ſayling iuſt North and South, you doe alwayes abide vnder one ſelfe great circle, called the Meridian, vnder the which, when you haue ſayled ſo farre as the Altitude of the Pole is changed one degrée, then haue you gone 17. Spaniſh Leagues, and a halfe, and you haue to note that euery Spaniſh league containeth 2857 Fathoms, and that our Engliſh league containeth no more but 2500. fathoms, ſo as the Spaniſh league is more then our Engliſh league by 357. fathoms, and euery fathom containeth ſixe féet. Againe, in ſayling Eaſt & Weſt, you do alwayes remayne vnder one ſelfe Parallel, by meanes whereof the Altitude of the Pole doth neuer alter, & therefore no true account can be made of the leagues, but by ſuch meanes as Cogniez teacheth in the Chapter following. But if in ſayling North and South, you decline our Rombe, either towards the Eaſt or Weſt, and go ſo farre as the Altitude of the Pole is changed by one degrée, then you haue made ſomewhat more then 17. Spaniſh Leagues and a halfe, and to be ſhort, the more Rombes that you decline towards the Eaſt or Weſt, the more leagues in number doe belong to one degrée of Altitude, as you may plainly ſée by this figure demonſtratiue here following, in which the letter A. ſignifieth the place or point in the Card, from which you depart, ſituated in the Parallell A.B.



Then

Then ſuppoſe C.D. to be another Parallel, equally diſtant from A.B. by one degrée of altitude. Now if you ſaile right Eaſt or Weſt, then you ſhall alwaies remaine in the Parallel A.B. equally diſtant from the Pole. But if you ſaile from A. right North, ſo farre as the Altitude of the Pole is augmented one degrée, then your ſhip ſhall be in C. and if you ſaile by the firſt rombe towards the Eaſt, ſo farre as the Pole doth alter in Altitude, one degrée, then your ſhip ſhall be in E. and thereby your way muſt néeds be longer, and ſo conſequently the more rombs you decline from North to Weſt, the longer is your way, and the more Leagues muſt bée accounted to one Degrée of Altitude, as the lines drawne from A. to E.F.G.H.I.K. and D. doe ſhew. And whatſoeuer is ſaid here of the quarter from North to Eaſt, the ſame is to be vnderſtood in all the other thrée quarters, that is, from North to Weſt, from South to Eaſt, and from South to Weſt. But if you will know how many Leagues doe belong to euery degrees, according to the rombe whereby you ſaile, then conſider well this Table here following.

For in ſailing from North or South, towards Eaſt or Weſt, ſo farre as you come to change one degrée of Altitude of the Pole, the ſaid degrée doth require for the firſt rombe, &c.

The firſt Table.

Rombes.	Leagues.
1	$17\frac{3}{8}$
2	$18\frac{14}{15}$
3	$21\frac{1}{20}$
4	$24\frac{3}{4}$
5	$21\frac{1}{2}$
6	$45\frac{3}{4}$
7	$89\frac{2}{3}$

Now then to know how much way you haue made in ſailing, you muſt firſt know as well the latitude of the place from which you departed, as of that place whereunto you be arriued: then by the foreſaid Table ſéeke to know how many Leagues doe belong to a degrée of that rombe whereby you haue ſailed, for in multiplying the number of the Leagues by the degrées of the difference of the two Latitudes, the product thereof will ſhew you how many Leagues you haue ſayled, notwithſtanding,

ſith

ſith the way may be made longer or ſhorter by changing or ſhifting of the winde, it is needfull that the Pilot haue conſideration thereof, who by ſkilfull coniecture muſt ſometime, either adde to, or take fro, according as néed ſhall require. Moreouer, by the foreſaid figure marked with letters, you may alſo eaſily vnderſtand how much you change in Longitude, that is to ſay, how much you are diſtant from the Meridian of that place from whence you departed, be it either towards the Eaſt or Weſt, for he that ſaileth from the point A. as is aforeſaid, right North or South, he remaineth alwaies vnder one ſelfe Meridian: but he that ſaileth by the firſt rombe towards the Eaſt or Weſt, ſo far as he changeth one degrée of Altitude, and arriueth to the point E. is now diſtant from his firſt Meridian ſo much as the ſpace betwixt C. and E. which we find by computation to be thrée Leagues and a halfe for one degrée of Latitude, which amounteth to twelue minutes of a degrée, and ſo of the reſt of the rombes, as appeareth by this Table héere following.

The ſecond Table.

Rombes	Leagues	Degrees & minutes of longitudes.	
firſt	3 ½	0	12
ſecond	7 ¼	0	25
third	11 ⅔	0	40
fourth	17 ½	1	0
fift	26 ¼	1	30
ſixt	42 ¼	2	25
ſeuenth	88 0	5	2

For in ſailing from North or South towards Eaſt or Weſt, ſo farre as you change one degrée of altitude of the Pole, you change alſo your Meridian, and thereby your longitude, the quantitie whereof anſwerable to euery romb is ſet downe on the right ſide of this Table.

And to make this more plaine by example, ſuppoſe that you ſayle from Lisbone, which is a famous Port in Portugale, by the wind Southweſt and by weſt, which is the fift Rombe from South to Weſt, ſo farre as you find the altitude of the Pole to bée 18. deg. leſſe then at Lisbone. Now if you would know how many leagues you haue ſailed, & alſo how much the Meridian of that place is more Weſtward then the Meridiã of Lisbone, then doe thus: Looke in the firſt Table, and you ſhall find, that to one degrée of the fift Rombe do belong 31. leagues and a halfe which

leagues being multiplied by 18. doe make in all 582. leagues and ¼. which you haue ſailed. Then looke in the ſecond Table, and you ſhall find for the fifth rombe one degrée and 30. minutes of longitude, which being multiplied by 18. and a halfe, do make 27. degrées and ¼. of a degrée, for by ſo much is Lisbone more Eaſtward then the place where you are. And whereas the firſt Table is made according to the proportion of right lines, ſuch as are commonly drawne in Mariners Cardes, Cogniet maketh another Table according to the proportion of circular lines, which for that it differeth very little or nothing from the firſt table, I omit heere to ſet it down. But now becauſe the firſt Table doth chiefly ſerue thoſe that ſaile either Eaſt or Weſt, in any Parallel betwixt the Equinoctiall and the 60. degrée of latitude or Altitude of the Pole: and that from thenceforth by reaſon that they ſaile by more oblique and ſpirall Circles do make the longer voyage, Cogniet thought good to ad a third Table, ſhewing how many leagues be anſwerable to one degrée of Altitude, to thoſe that ſaile either Eaſt or Weſt in any Parallel that is betwixt the pole and the 60. degrée of Altitude which Table differeth not much from the others in the firſt foure rombs, but in the thrée laſt, that is in the 5.6. and 7. rombe it differeth greatly, and moſt in the ſeuenth, as you may eaſily perceiue, by comparing this and the firſt Table together.

The third Table.

	Deg.	M.		Leagues.	
The firſt rombe hath	1	1	Which according to the proportion of 17. leagues & a halfe, for one degree doe make for euery rombe ſo many leagues as this Table ſheweth.	17	19/24
the ſecond rombe	1	5		18	23
the third rombe	1	12		21	0
the fourth rombe	1	c 26		25	1/12
the fift rombe	1	50		32	1/12
the ſixth rombe	2	42		47	1/4
the ſeuenth romb	5	44		100	1/3

CHAP. XXXIII.

How to account the leagues in ſayling directly Eaſt or Weſt, without changing the Latitude or Altitude of the Pole.

IN ſailing right Eaſt & Weſt, you continue ſtill in one ſelfe Parallel without making any change of Latitude. Moſt men therefore thinke it is impoſſible for you to make any true account of the Leagues, but onely by coniecture, for remedy whereof Cogniet hath inuented a rule moſt certaine, as he ſaith, the foundation whereof is thus. Firſt, you muſt ſuppoſe the Meridian of that place, from whence you depart, to be a firme and fixed point, and to be the very beginning of that Parallel wherein you ſaile, then you muſt know what houre is aſwell at the place from whence you firſt departed, as alſo at the place whereunto you are arriued, and hauing the difference of the houres, you muſt know how many leagues euery houre yeeldeth according to the Parallel of that Altitude of the Pole vnder which you ſaile, ſo ſhall you eaſily know how many leagues you haue ſailed. This foundation being firſt laid, Cogniet ſetteth downe this generall rule in this manner following: Whenſoeuer you haue to ſaile (ſaith hee) right Eaſt or Weſt, you muſt firſt prouide your ſelfe of theſe two things, the one is of an Aſtronomicall ring that may iuſtly ſhew the houre at any time: In ſtead whereof I thinke it better to haue an vniueſall Diall, ſuch a one as is deſcribed by William Bourne in the one and twentieth Chapter of his Regiment: the other thing is to haue a true houre Glaſſe that will run continually foure and twenty houres, and therefore had neede to be three times more long and large then common Houre-glaſſes be, whereof the Glaſſe-makers can quickely prouide, and becauſe the ſhip leaneth ſometime on the one ſide and ſometime on the other, it ſhall be needfull to hang the

ſayd houre-glaſſe with rings of Braſſe or Laten, to the intent that it may alwaies hang leuell, like as the Mariners Compaſſes are wont to be hanged in their boxes. Now being thus prouided of theſe two inſtruments, you muſt at your departing prepare your houre-glaſſe, that is to ſay, you muſt ſet it a running iuſt at noone, when the Sunne is right South, not forgetting to turne it in your voyage once a day, in the very inſtant that it is ready to runne out. Then hauing ſailed certaine daies, and being arriued at the place where you would know what way you haue made, looke to your houre-glaſſe, and tarry vntill it be full runne out, at which inſtant ſeeke to know what houre it is by your Aſtronomicall ring, or rather by the vniuerſall Diall, for if you ſaile Eaſt, you ſhall find it to bee paſt noone, but if you ſaile Weſt, then it will want of noone, and keepe thoſe houres in minde, that you may know how much it is more, or leſſe then noone for thoſe houres, by ſhewing the difference of the houres, that are betwixt the Meridian of the place from whence you departed, and the Meridian of the place whereto you are arriued, will certifie you with the helpe of this Table heere following, what quantity of way your ſhip hath made.

A Table to helpe you to know what way your ſhip hath made in ſailing right Eaſt or Weſt, without changing your Latitude, together with a briefe deſcription and vſe thereof.

De. of latit.	Leagues.	D. of latit.	Leagu.	D. of latit.	Leagu.	D. of latit.	Leagu.
0	262 1/2	23	241 1/2	46	182 1/4	69	94 1/8
1	262 [illegible]	24	239 3/4	47	179	70	89 3/4
2	262 1/4	25	238	48	175 5/8	71	85 1/2
3	262 1/8	26	236	49	172	72	81
4	262	27	234	50	168 3/4	73	76 2/3
5	261 1/2	28	231 7/8	51	165	74	72 1/3
6	261	29	229 1/2	52	161 1/2	75	68
7	260 1/2	30	227 1/4	53	157	76	63 1/2
8	259 7/8	31	225	54	154 1/4	77	59
9	259	32	[illegible]	55	150 1/2	78	54 1/2
10	258 1/2	33	220 1/4	56	146 3/4	79	50
11	257 1/2	34	217 1/2	57	143	80	45 1/2
12	256	35	215	58	139	81	41
13	255 3/4	36	212 1/3	59	135	82	36 1/2
14	254 2/3	37	209 3/4	60	131	83	32
15	253 1/2	38	206 7/8	61	127	84	27 1/2
16	252 1/4	39	203 5/6	62	123	85	22 3/4
17	251 1/8	40	201	63	119	86	18 1/4
18	249 2/3	41	198	64	115	87	13 3/4
19	248 1/4	42	195	65	111	88	9 1/4
20	246 3/4	43	192	66	100 3/4	89	4 2/3
21	245	44	188 3/4	67	102 1/2	90	
22	243 1/2	45	185 1/2	68	9 1/4		

This Table as you ſee conſiſteth of foure columnes, in euery one whereof are ſet downe on the left hand the degrees of Altitude of the Pole, and next to that on the right hand the Leagues, anſwerable to euery degree, the vſe whereof is thus: Firſt, ſeeke out in the ſaid Table the degree of Altitude, belonging to that Parallel, vnder which you ſailed, and next to that on the right hand, you ſhall find the number of leagues incident to that degree: which number of leagues, if you multiply by the number of houres befoꝛe found, the pꝛoduct thereof will ſhew you how many leagues you haue ſailed. And if there be any minutes annexed to the houres, then multiply alſo the number of the foꝛeſaid leagues found in the Table by thoſe minutes, and diuide the pꝛoduct thereof by 60. and the quotient ſhall be leagues, which you muſt adde to the foꝛmer leagues, and the ſumme thereof will ſhew how many leagues you haue in all ſailed.

Chap. XXXV.

An example of counting the way of your Ship, in ſailing right Weſt.

Suppoſe that you haue to ſaile from ẏ Cape ſaint Vincent in Spaine right Weſt, and therefoꝛe you pꝛepare your houre-glaſſe, as it may beginne to runne iuſt at noone, and hauing ſayled eight oꝛ nine dayes, (not foꝛgetting once, euery day, to turne your houre-glaſſe) you do arriue at one of the Iles of the Azores, called S. Marie, and there hauing tarried vntill your houre-glaſſe bee cleane runne out, and ſeeking to know at that inſtant by your Aſtronomicall ring, oꝛ by ſome vniuerſall Dyall, what houre it is, you find that it is 11. of the clock and 10. minutes paſt, which wanteth 50. minutes of iuſt noone, and that is the difference betwixt ẏ two Meridians, that is to ſay, the Meridian of Cape S. Vincent, and the Meridian of the Ile of S. Marie; both which places being in one ſelfe Parallel, muſt needs haue one ſelfe Latitude oꝛ Altitude, which is 37. degrees, which Altitude being found in the Table in the ſecond collume on the left hand, you find there alſo hard by it on the right hand 209. leagues, and ¼. of a league, for euery houre of that Parallel, which number of leagues, if you multiply by the foreſaid 50. minutes, the product ſhall be 10487.½. which if you diuide by 60. you ſhall find in the quotient 174. leagues, and $\frac{12}{17}$. parts of a league, which is the iuſt quantitie of your whole voiage.

CHAP. XXXVI.

Another example of counting the way of your ſhip, in ſailing right Eaſt.

Suppoſe then that you haue to ſaile from the new found Land, right Eaſt in the Parallel of 50. degrées: & hauing cauſed your houre-glaſſe to beginne to runne iuſt at noone, you ſet foorth and ſaile the ſpace of 15. dayes, not forgetting euery day once to turne your houre-glaſſe. Now if at the 15. daies end, you would know how many leagues you haue ſailed, to find in your Card in what place you are, you muſt firſt tarry vntill your houre-glaſſe be cleane runne out, and at that inſtant ſéeke by your Aſtronomicall Ring, or by ſome vniuerſall Dyall, to know what houre it is, which becauſe you haue ſailed right Eaſt, you find to be two houres and twelue minutes afternoone, then reſorting to the Table aforeſaid, you find in the third collume the 50. degrées of altitude, together with the number 168. leagues and a halfe, annexed to the ſaid degrée for one houre of that Parallel; which ſumme being multiplyed by two houres, maketh 337. leagues, then multiply once againe 168. by the odde ½. and diuide the product thereof by 60. ſo ſhall you find in the quotient 33. leagues and ſomewhat more, which being added to the former ſumme 337. leagues, will make in all 370. leagues and a little more, and that is the true quantity of your voiage. And Cogniet ſaith, that by practiſing this way of counting, you may know euery day, yea euery houre, what way your ſhip maketh in ſailing Eaſt or Weſt.

CHAP.

CHAP. XXXVII.

To know how much you goe of your way, in ſailing by one wrong Rombe, or by more.

If in ſailing to any place you direct your courſe either too high, or too low by one Rombe, you looſe in euery 100. leagues 19. leagues and ¼. of a league, ſo as you goe out of your way, almoſt the fift part of your voiage. And if by two rombs, then in euery hundred leagues you looſe 39. leagues, that is to ſay, you goe ſo farre out of the right way: And if you fall thrée rombs out of your right courſe, then in euery hundred leagues you looſe 58. leagues: and if you fall foure rombs, then you looſe in euery hundred leagues 76. leagues: and the more rombs that you miſtake in your direction, the more you wander out of your right courſe. Thus much touching the Marriners Compaſſe and his Card: now we will ſpeake of the North Starre, and of his guards, and then of the Sunne and of the Moone, and ſo end.

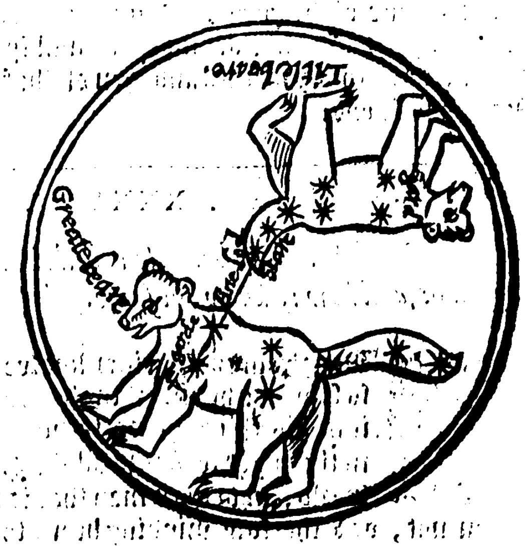
CHAP. XXXVIII.

Of the North ſtarre, otherwiſe called the Loadſtarre, and his guards, and how to know the ſame.

Though euery Mariner knoweth the North ſtar ſo ſoone as he ſéeth it in the firmament, becauſe it is his chiefe guide to direct thereby his ſhip in the night ſeaſon, in all the North parts of the world, yet euery man that is no Sailer knoweth him not, and therefore minding héere to treat thereof, I thinke it not amiſſe firſt to teach him how to know it, and in what part of the heauen it is placed, and how farre it is diſtant from the North Pole.

Tha

The Poets doe faigne that of the 48. Images of the fixed ſtars that be in the heauen, which are otherwiſe called Conſtellations, there be two Beares hauing tailes, whereof the one is called the great Beare, and the other the little Beare, in euery of which are ſeuen principall ſtars: And that bright ſtarre which is in the very tip of the little Beares taile, is commonly called of our Engliſh Mariners the Loadſtarre, of the Latines Stella Polaris, of the Greeks Cinoſura, & of the Arabians Alrucuba. But to know this ſtarre, you muſt firſt find out the ſeuen ſtarres of the great Beare, by looking towards the North part of the firmament, of which ſtarres foure being placed in his body, doe make (as it were) a foure ſquare, and the other three ſtarres being placed in his taile, which is ſomewhat riſing in the midſt, do repreſent the portion of a Circle, the little Beare hath alſo the like ſhape, ſauing that her feet and belly doe turne vpwards, ſo as the tippe of her taile is anſwerable to the two hindermoſt ſtars of the great Beare, as you may ſee in theſe figures following.



Some doe call the great Beare Great Charles Waine or Wagon, and the little Beare, little Charles Waine, becauſe in each figure the foure ſquare ſtars doe ſignifie the foure wheeles, and the other three ſtars the three horſes: Now, to finde out the Loadſtarre, imagine a right line to paſſe through the two hindermoſt ſtarres, otherwiſe called the guards or pointers of the great Beare, as you ſee here in this figure, & that line will rightly direct your eye to the Loadſtarre which ſtandeth in the tip of the little Beares tayle, for there is no bright ſtar that can be ſeene betwixt the 2. guards of the great Beare and the Loadſtarre. Notwithſtanding ſome doe affirme that there is another ſtar nigher vnto the Pole, then the foreſaid Loadſtarre, and that ſtarre is, as they ſay, no more but 50. minutes diſtant from the Pole: I haue heard that there is a Prieſt an Aſtrologer with the King of Denmarke, who is wont to find out this ſtar by the helpe of an Inſtrument, whereby hee getteth firſt the ſight of fiue other ſtarres at one inſtant, which way, I feare me, is more troubleſome than profitable, & if there were any ſuch ſtarre indeed, and therewith ſo needfull and meet to be vſed, as is the Loadſtarre, I doubt not but that ſome of our learned Pilots would haue found it out, and alſo haue had ſome vſe thereof long ere this time. But leauing this matter, I will returne to the deſcription of our Mariners common Loadſtarre, and ſhew of what bigneſſe it is: alſo what Longitude, Latitude, Declination, and Motion it hath, and finally, the chiefeſt and moſt neceſſary vſes thereof.

This Starre, according to the Prutenicall Tables, is of the third bigneſſe: and hath in Longitude 53. Degrees, 30. Minutes, counting from the firſt ſtarre of the Rams horne, whoſe place in theſe our dayes is in the 27. Degree, 30. Minutes of Aries, and by this meanes the place of Longitude of the Loadſtarre, or Pole ſtarre, is in the 21. Degree of Gemini, and his Latitude, counting from the Eclipticke line towards the North Pole of the Zodiaque is 66. Degrees, 0. Minutes, and his Declination counting from the Equinoctiall, towards the North Pole of the World is 86. ſo as he is in theſe dayes diſtant from the North Pole 4. Degrees, ſome ſay 4. degrees and nine Minutes, but Cogniet ſaith, that he is diſtant from the Pole but 3. Degrees and a halfe, who findeth by the Aſtronomicall Tables that this ſtarre at the Birth of Chriſt, was twelue Degrees 36. Minutes diſtant from the Pole, and euer ſince hath gone decreaſing, and ſhall decreaſe euery day more then other, vntill it come to be but 26. Minutes diſtant from the Pole, which is as nigh as it can approch to the Pole, for then his diſtance ſhall beginne againe to increaſe, it being alreadie come ſo neere, as

it

it is not aboue two degrees 52′. diſtant from the Pole. This Starre maketh his daily reuolution from Eaſt to Weſt in 24. houres, as all other ſtarres doe by vertue of the firſt moueable, but his circuit is ſo ſmall, and his gate ſo ſlow, as in the ſpace of 24. houres he goeth not much more then 24. degrees of the Equinoctiall, and in his turning round about he maketh as it were a little Circle, in the middeſt whereof is the North Pole it ſelfe, which is inuiſible and cannot be ſeene.

And though the Image or conſtellation of the little Beare contayneth many ſtarres, yet the ſeuen before mentioned, and ſet forth in figure, are moſt obſerued, of which ſeuen ſtars in the little Beare, two ſtars called the guards of the North ſtar, are to the Mariners moſt familiar, for diuers reſpects hereafter declared. And of thoſe guards, the one is Northerne, and the other Southerne, and both are ſaid to bee of the ſecond bigneſſe, and yet the Southerne guard ſeemeth to the eye both leſſer and darker then the other. Of which to ſtars, I thinke it not amiſſe to ſet downe here the Longitude, Latitude, and Declination, as I haue done before of the Loadſtarre.

The Longitude of the South guard is 100. Degrees 30. Minutes, whereby his place is in the ninth degree of Leo. And his Latitude is 72. Degrees 40. Minutes, and his declination is 73. Degrees, ſo as he is diſtant from the North Pole 17. Degrees.

The Longitude of the North guard is 109. Degrees, 30. Minutes, ſo as his place is in the 20. degree of Leo, and his latitude is 74. degrees, 50. minutes, and his declination is 76. degrees, ſo as his diſtance from the North Pole is 14. degrees. Thus hauing ſhewed the greatneſſe, the longitude, the true place, the latitude, and the declination aſwell of the Loadſtarre, as of his two guards, I thinke good now to ſet downe the chiefeſt vſes that Sea-men haue of them.

CHAP.

CHAP. XXXIX.

The vſes of the North ſtarre, and of his guards.

THe firſt vſe is to know thereby the variation of the Mariners Compaſſe.

The ſecond is to know by his guards, when the North ſtarre is aboue or beneath the Pole.

The third is to know by the North ſtarre and his guards, with the helpe of an inſtrument called a Nocturlabe, the houre of the night.

The fourth is to know the eleuation of the Pole. And you haue to note that the North ſtarre and his guards are alwayes aboue our Horizon, and doe neuer goe down in any place, whereas the North Pole hath any eleuation, be it neuer ſo little. But beſides theſe ſtarres, there be alſo in this our latitude diuers other Images of ſtarres that are alwaies aboue our Horizon, and doe neuer goe downe, as the Dragon, the great Beare, the Image of Cepheus, of Caſſiopeia, the Image of Auriga, hauing the Goat at his backe, which is a faire bright ſtarre of the firſt bigneſſe, and many others which I leaue to name, becauſe I haue heretofore deſcribed them all at large in my Treatiſe of the Globes, by which ſtarres by reaſon that with vs they neuer goe downe, the latitude of any place, and alſo the houre of the night may be knowne ſo well as by the Load-ſtarre.

But now as touching the vſes of the foreſaid ſtarres before mentioned, the firſt whereof ſhewing how to find out by the Loadſtarre the variation of the Compaſſe, is taught before in the 25. Chapter, according to William Bourne his rule ſet downe in his Regiment, and as for the other three vſes they are plainly taught in the two Chapters next following.

CHAP.

CHAP. XL.

To know by helpe of a little table, made according to the Mariners rule, touching the eight principall rombs, ſhewing how & when the Loadſtar is either aboue or beneath the Pole, that you may know thereby the true Altitude of the Pole, in taking the height of the Loadſtar with your Aſtrolabe, or croſſe-ſtaffe.

To know this, you muſt alwaies haue due conſideration of the two guards of the little Beare, for when thoſe guards are iuſt South-weſt from the Loadſtarre, then is the Loadſtarre at his higheſt in the very Meridian, and therefore it is right aboue the Pole, and when thoſe guards be iuſt North-eaſt from the Loadſtarre; then the Loadſtarre is againe in the Meridian at his loweſt, and therby right vnder the Pole, and in both places his diſtance from the Pole, is but thrée degrées and a halfe, as Cogniet ſaith: according to which account he ſetteth downe this Table following.

This Table is diuided into two columnes, whereof that on the left hand containeth the eight principall rombs or winds, and that on the right hand containeth the degrées and minutes of diſtance of the Loadſtarre from the Pole, being either aboue or beneath the Pole: But that Table of Cogniet being ſince lately corrected, and more truly calculated, is inſerted in ſtead of the other.

	The Rombes or windes.		The degrees and minutes of the declination of the Loadſtarre from the Pole.		
If the guards be	Weſt,	Then the Loadſtarre is	0	37	Aboue the Pole.
	South-weſt,		2	50	
	South,		2	24	
	South-eaſt.		0	34	
	Eaſt,		0	37	Beneath the Pole.
	North-eaſt,		2	50	
	North,		2	24	
	North-weſt.		1	34	

This

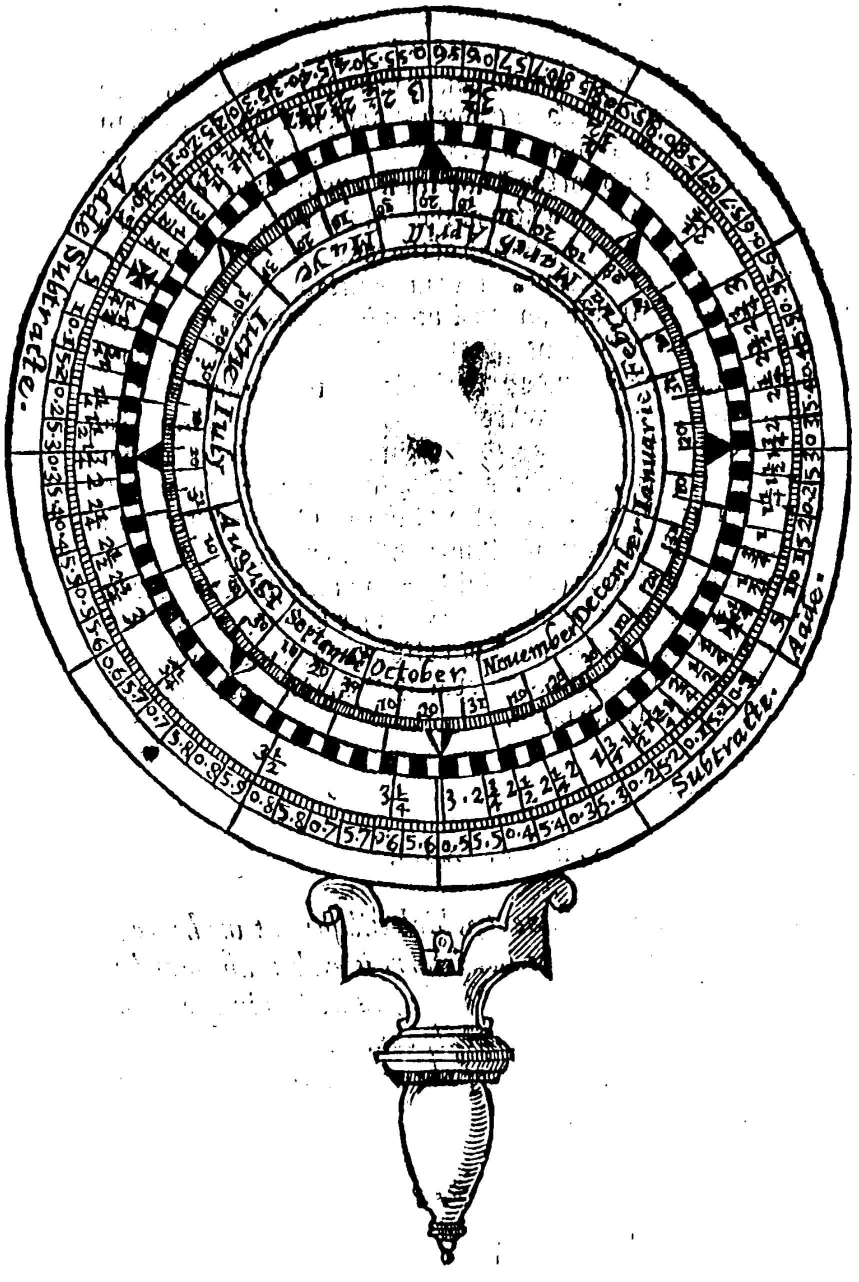
This Table differeth much from the Mariners common rule ſet downe as well by Medina, as alſo by William Bourne, touching the guards, for they all appoint but halfe a degrée of declination of the Northſtarre from the Pole, the guards being either in the Rombe Southeaſt, or Northweſt, to both which Rombes Cogniet appointeth one whole degrée of declination, and here we allow only 34′. The vſe of which Table, in ſéeking to know the eleuation of the Pole is thus. Firſt, hauing taken with your Aſtrolabe the Altitude of the Loadſtarre aboue your Horizon, obſerue immediately in which of the eight former Rombes his guards be: For if they be in any of the foure vpper Rombes of ẏ Table, then you muſt ſubtract from the height of the Loadſtar taken with you Aſtrolabe, ſo much as is ſet downe for ẏ Rombe in the collum on the right hand of the ſaid Table, & the remaynder ſhall be the true Altitude of the Pole, but if the guards be in any of the foure nether Rombes, then you muſt adde ſo much to the height of the Loadſtarre, and the ſumme thereof ſhall bee the Altitude of the Pole. But becauſe this Table ſerueth only for the eight principall winds, and for no more, Cogniet therefore ſetteth downe the making of a two-fold Inſtrument, whereby you ſhall not only know (as he ſaith) how much the Loadſtarre is aboue or beneath the Pole, in euery other Rombe, as well as in the eight principall Rombes, but alſo you ſhall know thereby the true houre of the night more exactly, than the Nocturlabe of Munſter or Appian doth ſhew.

CHAP. XLI.

How to make an Inſtrument, which will ſhew at any houre of the night, how much the Loadſtarre is eyther aboue or beneath the Pole, in euery other Rombe, as well as in the eight principall Rombes, which are only contayned in the former Table, and alſo the true houre of the night, the ſhape whereof followeth.

The

The ſhape or figure of the Rectifier of the North Starre.



Cogniet calleth this inſtrument Rectificatorium Stellæ Polaris, that is to ſay, the Rectifier of the North ſtar, ioyning thereunto a Nocturlable differing nothing at all from the Nocturlable of Munſter and of others, but onely in placing the 21. of October in ſtéed of the 28. of the ſame moneth, vpon the line of North and South, towards the handle of the inſtrument for ſuch cauſe as is héreafter declared.

The making of the rectifier of the Loadſtarre, is thus: Vpon a ſmooth péece of board of firme wood, or vpon a péece of poliſhed plate of braſſe, or Lattin, being ſixe or ſeuen inches broad, hauing a handle, as you ſée in the former figure, draw a Circle diuided into 4. quarters by helpe of two croſſe Diameters, cutting one another in the Centre with right Angles, the perpendicular whereof ſhall ſignifie the Meridian line, that is to ſay, the line of North and South, at whoſe vpper end ſet North, and at the nether end South, and the other ouerthwart Diameter ſhall be the line of Eaſt and Weſt, hauing Eaſt marked on the right hand, and Weſt on the left hand, & in euery quarter of the foreſaid circle you may if you will place the like rombes that are in the Fly of the Marriners compaſſe, as you may ſée done in the foreſaid figure. Moreouer, you muſt diuide the vpper quarter on the left hand into thrée equall parts, and hauing taken two of thoſe parts with your Compaſſes, meaſuring from the North point downe towards the Weſt, and there make a pricke, marking the ſame with a little blacke croſſe, & from that croſſe draw a right line yͭ may paſſing through the Centre, into the circumference of the Circle, and there make another little blacke croſſe, and this line ſhall diuide the circle into two equall parts, which line if you croſſe with another right line, paſſing through the Centre, and making thereby right Angles, you ſhall diuide the Circle into other foure quarters differing from the firſt foure quarters, though not in quantity, yet in place, of which foure laſt quarters, you muſt diuide that which is on the left hand into 90. equall degrées, beginning your account at the little blacke croſſe on the left hand, and ſo proceed downewards toward the South point of the circle.

Now to know how much the North ſtar in euery rombe mounteth oꝛ deſcendeth, & how to place the ſame vpon the inſtrument, ſo as you may know how much to adde to the altitude of ẏ loadſtarre, oꝛ to ſubtract from the ſame, you muſt vſe this Table following, which Table conſiſteth of two collummes, whereof that on the left hand containeth the degrées and minutes of the declination of the Loadſtarre, procéeding from one quarter of a degrée to an other, vntill you come to 3. deg. and a halfe, which is as (Cogniot ſaith) the greateſt declination of the Load-ſtarre, from the Pole: and the other collum on the right hand conteineth the degrées and minutes of a quarter oꝛ quadꝛant, diuided by diuers and ſundꝛy propoꝛtions of numbers into 90. degrées, which propoꝛtionall degrées and minutes, are to bee reckoned in the firſt quadꝛant, diuided into 90. equall degrées, and next deſcending from the firſt croſſe on the left hand, thus.

This Table being *Cogniets* inuention, in thoſe times were the beſt then knowne, but the truth being better explained, you may in the making of the Inſtrument, vſe this Table or that formerly ſpoken of at your pleaſure.

The degrees and minutes of the declination of the Loadſtarre from the Pole.	The Degrees and minutes of the Quadrant, diuided by diuers portions of numbers into 90. degrees.	
	Deg.	Min.
$\frac{1}{4}$	4	6
$\frac{1}{2}$	8	13
$\frac{3}{4}$	12	22
1 0	16	36
1 $\frac{1}{4}$	20	55
1 $\frac{1}{2}$	25	23
1 $\frac{3}{4}$	30	0
2 0	34	51
2 $\frac{1}{4}$	40	0
2 $\frac{1}{2}$	45	5
2 $\frac{3}{4}$	51	48
3 0	59	0
3 $\frac{1}{4}$	68	13
3 $\frac{1}{2}$	90	0

Firſt, beginning at the ſayd croſſe, and deſcending downeward, tell out 4. degrées and 6. minutes, and right againſt that ſet downe $\frac{1}{4}$. then tell in the ſame quadꝛant from the ſaide croſſe 8. degrées and 13. minutes, and right againſt that ſet downe $\frac{1}{2}$. and ſo procéede accoꝛding as the Table directeth you, vntill you come to 90. againſt which you muſt ſet downe 3. deg. and $\frac{1}{2}$. And as this quarter is diuided, ſo you may deale with the other thrée quarters, & in each of the two quarters which are beneath the two croſſes, foꝛget not to wꝛit this woꝛd Subtract, & in each of the two quarters, aboue ẏ two croſſes, wꝛite this woꝛd Adde, as you ſée in the foꝛmer figure, then there ſhall want nothing but onely a ruler oꝛ index, which muſt be faſtned to the centre of the inſtrument, ſo as it may be turned round about a pinne, hauing a round hole in it, thꝛough which you may ſée the Loadſtar, and alſo at the ſame inſtant by lifting vp and downe the Index, you may ſée on the outſide of the inſtrument the foꝛeguard of the ſaid Starre, appearing euen with ẏ right edge of the ind, excalled Linea fiduciæ, oꝛ the fiduciall line dꝛawne from the Centre of the inſtrument alongſt the inner edge of the Index, and ſo is the inſtrument foꝛ that purpoſe fully perfected. But if you would adde therunto a Nocturlabe, then you muſt dꝛaw vpon the center therof, diuers circles next to the ſpace containing the winds, and the ſpaces betwixt thoſe circles muſt bee ſome wider, and ſome narrower: For the firſt vpper ſpace muſt be narrow, containing the daies of euery moneth, and the next ſpace ſomewhat wider, containing the number of thoſe daies ſet downe in Arithmeticall figures, and the third ſpace wider then that, containing the names of the moneths, then next to the loweſt circle of the nethermoſt ſpace, place a little rundle faſtened to the inſtrument with the foꝛeſaid hollow pin, ſo as it may turne round about the ſame. And this rundle muſt be diuided into 24. houres, that is to ſay, 12. foꝛ the day, and 12. foꝛ the night, which rundle would be made with téeth, whereof one muſt be longer then all his fellowes, ſignifying alwaies the 11. houre of the night, which is alwaies to be laid vpon the day of the month wherein you ſéek to know the houre of the night. And remember in diſtributing the daies of the moneth, that you alwaies ſet the 21. of October, beneath towards the handle in the very line of North & South, paſſing right thꝛough the middeſt of the handle, ſo ſhall the inſtrument ſhew the houre of the night moꝛe truly then when the 28. day of October, ſtandeth beneath vpon the line of South and North, as it doth in the common Nocturlabes, the makers whereof had reſpect to the Pole it ſelfe which is inuiſible, and not to the Noꝛthſtarre which is apparent to the eye, by meanes whereof the guards of the Loadſtarre ſometime doe ſhew ſooner oꝛ latter by ſeuen degrées, and 18. minutes, if you count from the Pole, which is almoſt halfe an houre difference, and foꝛ that cauſe alſo Cogniet maketh his account in his foreſaid Rectifier to beginne at the little blacke croſſe, ſeuen degrées more forward then it ought to doe, if he ſhould count from the Pole, and not from the North ſtarre.

CHAP. XLII.

How to know by the foreſaid twofold inſtrument, as well the mounting and deſcending of the North Starre, as the true houre of the night both at one inſtant, and alſo the eleuation of the Pole.

FIrſt then hauing laid and ſtaied the great tooth of the moueable rundle, marked with 12. vpon the day of the moneth wherein you ſéeke, and holding the inſtrument by the handle, with your one hand right before your face, leaue not to put that hand forward from you, or to bring it backwards towards you, vntill you may ſée with the one eye, winking with the other, the North ſtarre through the hole of the pin, which is in the Centre of the Inſtrument: and ſo ſoone as you ſee the North ſtarre, lift with your other hand the index vp and downe, vntill you ſee alſo at that inſtant the North guard of the Loadſtarre, on the outſide of the inſtrument, appearing euen with the fiduciall line, or inward edge of the ſayd index. Then ſtaying the index there, looke vpon what houre it falleth, for that ſhall be the houre of the night. And looke alſo at that inſtant vpon what degrée of diſtance it falleth in the outtermoſt border of the inſtrument, wherein thoſe degrées are ſet downe together with theſe words, adde and ſubtract. For from the point marked with a little black croſſe nigh vnto the Northweſt, deſcending through the nether moiety, or halfe deale of the Inſtrument, vntill you come to yͤ other blacke croſſe, placed nigh vnto the Southeaſt, the North ſtarre is alwaies aboue the Pole ſo much as the index ſheweth, which you muſt alwaies ſubtract from the height of the North ſtarre, to know the eleuation of the Pole, hauing firſt taken with your Aſtrolabe the height of the North ſtarre. But if the index doe fall vpon any degree or part of a degrée in the vpper moitie or halfe deale of the inſtrument, then to know the eleuation of the Pole, you muſt adde ſo much as the index ſheweth vnto the altitude of the Loadſtarre, as the words Adde and Subtract written in the outermoſt border of the inſtrument doe plainely ſhew.

But now if you would know at any houre of the day or night, in what rombe the foreſaide guards be, without ſéeing them, and alſo how much the Loadſtarre is declined from the Pole, you néede doe no more but to lay the great tooth of the moueable rundle vpon the day of the moneth, and then to bring the Index vnto the houre which you require, and the ſayd Index will ſhew in the border of the inſtrument in what rombes the guards be, and how much the North ſtarre is aboue or beneath the Pole.

I haue found by often triall that this inſtrument wil ſhew the true houre of the night, and alſo in what rombe the guards bée, and thirdly, how much the North ſtarre is at any time, either aboue or beneath the Pole, and by adding the degrée of diſtance found in the limbe of the inſtrument, or by ſubtracting the ſame according to the rule before giuen from that altitude of yͤ North ſtar, which I haue before taken with my Aſtrolabe, I haue found at all times the true eleuation of the Pole, whereſoeuer I haue made triall therof. But ſith other ſtarres may perhaps appeare when the North ſtarre with his guards ſhalbe hidden, I would wiſh all carefull Mariners, to acquaint themſelues with as many bright ſtars as they can, and eſpecially with thoſe which do both riſe and ſet, and alſo to learne by ſome Table the declination of euery ſuch Starre, and whether it be Southernly or Northernly, for by taking the Meridian altitude of any ſuch ſtarre, and by adding to, or by taking from the altitude thereof, his declination, according as the ſame declination is either Northernly or Southernly (for if it be Northernly, then you muſt ſubtract his declination, and if it be Southernly, you muſt adde the ſame to the altitude of the Starre) you ſhall find thereby the altitude of the Equinoctiall, which being taken out of 90. the remainder will ſhew the eleuation of the Pole. The meeteſt Starres for this purpoſe in theſe our North parts of the world, are theſe, Hircus the Goate, Canis minor, the little Dog, Canis Maior, the great Dogge, Dexter humerus Orionis, the right ſhoulder of Orion. Cingulum Orionis, the Girdle of Orion. Cor Leonis, the Lyons heart. Bubulcus, the Bareward. Spica Virginis, the wheate eare in the hand of Virgo. Aquila volans, the flying Eagle. Caput Andromadæ, the head of Andromada. Ras Argo, the head of Meduſa. Oculus Tauri, the Buls eye, and diuers others.

And in any caſe conſider whether the declination of the Star be greater or leſſer then his Meridian altitude, for if his declination be greater, then his Meridian altitude, as of thoſe Starres which are nigh the Pole, then you muſt take his Meridian altitude with your Aſtrolabe at two ſeuerall times, that is to ſay, when he is at his higheſt in the Meridian, and alſo when he is at the loweſt point, of the ſame Meridian called the depreſſion, and hauing added thoſe Meridian altitudes together, take halfe thereof, and that halfe ſhalbe the eleuation of the Pole, which way of finding out ẏ eleuation of the Pole is nothing meet for a Mariner that is vnder ſaile. But now to proceede according to Cogniet his direction in this matter, he ſaith, ẏ if in ſailing you approach ſo nigh vnto the Equinoctial, as the eleuation of the Pole is not aboue 17. degrées then the guards are not ſo eaſily ſéene, wherefore it ſhall be néedfull to take ſome other ſtarre whereby you may both know the houre of the night, and alſo how much the Loadſtar is either aboue or beneath the Pole, and Cogniet thinketh none of the ſtarres more méet for that purpoſe then one of theſe two, that is, either the ſtarre called Caput Meduſæ, that is, the head of Meduſa called of the Arabians, Ras Algol, or elſe the Star called Hircus, that is, the Goat, both which are faire bright Starres and of the firſt bigneſſe: and the cauſe why he appointeth the head of Meduſa, is for that this ſtarre is directly oppoſite to the former guarde, in ſuch ſort as this ſtarre is alwaies aboue the Horizon, when both the guardes are vnder the Horizon. Wherefore hauing prepared your inſtrument, that is to ſay, hauing laide the longeſt tooth of the moueable rundle vpon the day of the moneth wherein you ſeeke, and hauing found out thereby in ſuch order as is before taught, the North ſtarre and alſo the ſtarre called the head of Meduſa, both at one inſtant, marke where the Index falleth, and immediately turne the Index from that point to the point oppoſite, abating twelue houres, and ſo the Index ſhall ſhew you thrée things at once: Firſt, the rombe wherein the guards are at that preſent. Secondly, the houre of the night. And thirdly, how much the North ſtarre is aboue or beneath the Pole. But becauſe this ſtarre is not knowne perhaps to all Mariners, Cogniet would haue you to take the other bright ſtarre called Hircus, which (as he ſaith) goeth 9. houres and $\frac{1}{2}$. before the guards, in ſuch ſort, as when the former guard is Eaſt, you ſhall find this ſtar counting from the North ſtar to be North-weſt, and almoſt 45. degrees diſtant from the Pole, with which ſtarre if you worke, as you did before with the head of Meduſa, ſauing that you ſhall not neede to turne the Index vnto the oppoſite point, but only to rebate from the point on which it falleth 9. houres and $\frac{1}{2}$. you ſhall know all the thrée things laſt mentioned. And this rule (as he ſaith) is ſo generall as you may haue your deſire by working in like manner with any other ſtar, that is to you certainely knowne, and is at that time aboue the Horizon.

CHAP. XLIII.

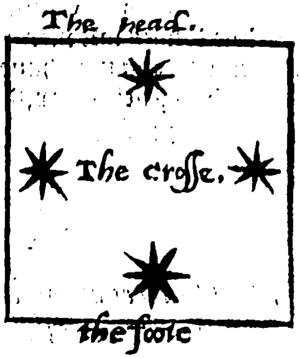
What Starres are obſerued by thoſe that ſaile beyond the Equinoctiall line vnder the South Pole.

THe ancient Aſtronomers, as Ptolomie, Timochares, Hyparchus, and others, did neuer deſcribe any Starre to be more nigh vnto the South Pole, then that which is called Canopus, which is a faire bright Starre of the firſt bigneſſe, and according to the Tables of Copernicus, is diſtant from the South Pole 38. degrées, and $\frac{1}{2}$. But thoſe that haue ſailed in the South Seas of latter daies, haue found out other ſtarres vnknowne to the ancient Aſtronomers, which are much nearer vnto the ſaid Pole. For Albericus

bericus Veſputius writeth of three Starres, making together a Triangle Orthogonall, that is to ſay, hauing one right angle, now called the Southern Triangle, the middle Starre whereof is diſtant from the South Pole 9. degrees, $\frac{1}{3}$.

There be alſo lately found out diuers images of other ſtars nigh vnto the South Pole, as that which is called Noah his Doue, or Pigeon, and another called Polophilax, made in the ſhape of a man, whoſe longitude and latitude hath not as yet beene rightly ſet downe by any that I haue read.

But the Sea-men of theſe preſent dayes doe moſt commonly obſerue foure great ſtars, which according to the ſhape & forme thereof they call the Croſſe, imagining the greateſt ſtarre of the foure to be the foot, and that which ſtandeth right ouer him to be the head of the croſſe, & the other two to be two armes: and when they ſee, that the head doth directly anſwer yͤ foot, then they ſay that the foot of the ſaid Croſſe is right aboue the Pole, & diſtant from the ſame 30. degrees. Therefore hauing taken the altitude or height of that ſtar aboue the Horizon with their Aſtrolabe they ſubtract 30. degrees from that altitude, and the remainder is the eleuation of the Pole. Medina in his firſt booke and 11. Chapter ſetteth downe the ſhape of the foreſayd Croſſe in this manner.



And he ſaith, that theſe ſtarres are neither any of thoſe ſtarres that are appointed to the twelue Signes in the Zodiaque, nor yet any of the 36. Images or Conſtellations that be in heauen. Moreouer, he ſaith, that in taking the altitude of the great Star called the foot, being in his right place, that is to ſay, when he is directly oppoſite to the head, and that you find his altitude to be 30. degrees, then you may aſſure your ſelfe that you are right vpon the Equinoctiall. And if you find his altitude to be more then 30. degrees, then you are paſt the Equinoctiall towards the South Pole. But if you find it to be leſſe then 30. degrees then you are ſtill on the North ſide of the Equinoctiall.

Beſides the ſtarres aboue mentioned, our Mariners in theſe North parts of yͤ world, are wont to obſerue diuers other ſtars, to the number of 32. whoſe longitude and declination together with their bigneſſe, and alſo when they riſe and ſet, and when they are mounted to the Meridian, that is to ſay, are iuſt South, is plainely ſet forth by Tables, collected of purpoſe, out of the Aſtronomicall Tables by William Bourne, which Tables you ſhall find in the 20. Chapter of his booke, called the Regiment of the Sea. And Robert Norman doth alſo ſet downe the like tables, in his booke called the Attractiue, as alſo in other bookes more lately calculated: and therefore I thinke it ſuperfluous to repeat the ſame againe here, and ſpecially ſith I haue deſcribed vnto you all the ſtarres that bee in the firmament, that were knowne to the ancient Aſtronomers, and haue ſhewed you how to find out by the Globe their longitudes, their latitudes, their declinations, their greatneſſe, and all other accidents belonging to the ſtarres in my Treatiſe of the Celeſtiall Globe, which I wrote of purpoſe to further yong Sea-men.

The knowledge of the ſtarres ſerueth Sea-men chiefly to know thereby the latitude of any place, and alſo to know the houre of the night: and thirdly, to coniecture by their manner of riſing and ſetting, and other their aſpects, what weather is like to follow either foule or faire: the rules whereof to teach truely, belongeth to Aſtronomers, yet many Sea-men by diligent obſeruation doe attaine to right good iudgement therein. Wherefore leauing to ſpeake any further of the ſtarres, I will now briefly ſpeake of the Sunne and of his motions, of his riſing and ſetting in euery latitude, and of his declination from the Equinoctiall, and of other his like apparances. I ſay here briefly, because I haue already ſpoken of him at large in the firſt part of my Spheare, whereas I treat of the Zodiaque.

CHAP. XLIIII.

Of the Sunne, and of his motions, and of the chiefeſt apparances belonging to him.

THe Sunne according to the mouing of the firſt moueable, which is from Eaſt to Weſt, maketh his daily reuolution in 24. houres, as all other Starres doe; but according to his owne motion which is from Weſt to Eaſt, in going through the twelue ſignes of the Zodiaque, he ſpendeth a whole yeare; for his daily mouing vpon his owne Centre, called the excentrick, becauſe it is out of the Centre of the world, is little more then 59. minutes, 8. ſeconds, making thereby the whole yeare to conſiſt of 365. daies, fiue houres, 49. minutes, 8. ſeconds, 19. thirds, 37. fourths, 24. fifts: and this is called of Copernicus, the equall tropicall yeare, which taketh his beginning from the firſt point of Aries, otherwiſe called the vernall Equinoxe, into which point the Sunne entreth not euery yeare at one ſelfe day of the moneth, for ſometime he entreth into that point the tenth day, and ſometime the eleuenth day of March, which day of his entring is alwaies truly ſet downe in euery Ephemerides, and becauſe the beginning of the tropicall yeare is ſo vncertaine, the Aſtronomers doe make their yeare called the Syderall yeare, to beginne at the former ſtarre of the Rammes horne, and thereby, doe make the yeare to conſiſt of 365. dayes, 6. houres, 9. minutes, and 39. ſeconds, according to which yeare they alwaies rectifie or bring to equalitie, aſwell the equall as the vnequall tropicall yeare, of both which I haue ſpoken in the firſt part of my Spheare, the 38. and 39. Chapters.

Moreouer, the Sunne hath three motions, that is, ſlow, ſwift, and meane. His ſlow motion is when he is in the point called Auge or Apogeon, which is a point imagined to be nigh vnto the outermoſt edge of the Circle, which carrieth the body of the Sun called Deferens Solis, and is furtheſt diſtant from the Centre of the world, which point in theſe our daies is in the 9. degree of Cancer, or thereabouts. And being in that point, he goeth little more than 57. minutes in 24. houres. Againe, his ſwift motion is when he is in the oppoſite point to the Auge, called Perigeon, which point in theſe dayes is in the 9. degree of Capricorne, and being in this point, hee goeth one whole degree and almoſt two minutes in 24. houres, which is almoſt fiue minutes more then he maketh in his ſlow motion, His meane motion is when he is in the midſt betwixt the two foreſaid points, whereas in foure and twentie houres hee goeth one whole degree and ſomewhat more than two minutes. And theſe three ſundry motions doe cauſe the Equinoctiall points not to be of Equall diſtance. For the Sun ſpendeth 7. daies and ſomewhat more, in going from the Equinoxe of March, to the Equinoxe of September, than hee doth in going from the Equinoxe of September to the Equinoxe of March. For if in this preſent yeare 1612. which is leap yeare, you count the dayes from the Vernall Equinoxe, which is the eleuenth of March, vnto the Autumne Equinoxe, which is the 13. of September, you ſhall find the number of the dayes to bee 186. and the other number from the 13. of September to the eleuenth of March, to be but 180. which is leſſe than the firſt number by 6. dayes, and if it were not leape yeare, the difference would be ſeuen dayes, becauſe that Februarie in the leape yeare hath 29. dayes.

It is neceſſarie that Sea-men haue ſome vnderſtanding of the three foreſaid motions, to the intent that they may the better know the true place of the Sunne, and thereby his true Declination. And note that no calculation of his Declination can continue without errour aboue 24. yeares. For as often as the leape yeare commeth about, which is euery foure yeares, the Sunne is vpon the Equinoctiall ſooner by halfe an houre. But as for the true place of the Sunne, and eſpecially euery day at noonetyde, the Ephemerides doth moſt truly ſhew, and hauing his place, you ſhall eaſily find his Declination by this Table following, which will ſerue for theſe twentie yeares & more. the like whereof, together with the vſe of the ſame is ſet downe in the firſt part of my Spheare the 13. Chapter.

A Table ſhewing the Declination of the Sunne euery day throughout the Yeare, and the vſe thereof.

Degreds of the ſignes.	♈ ♎			♉ ♏			♊ ♐			Degrees of the ſignes.
	D.	M.	S.	D.	M.	S.	D.	M.	S.	
1	0	23	53	11	50	6	20	22	57	29
2	0	47	46	12	10	56	20	35	7	28
3	1	11	39	12	31	34	20	46	55	27
4	1	35	30	12	51	59	20	58	20	26
5	1	59	26	13	12	12	21	9	21	35
6	2	23	8	13	32	12	21	19	59	24
7	2	46	54	13	51	58	21	30	13	23
8	3	10	37	14	11	30	21	40	3	22
9	3	34	18	14	30	48	21	49	29	21
10	3	57	53	14	49	51	21	58	29	20
11	4	21	28	15	8	40	22	7	6	19
12	4	44	57	15	27	13	22	15	17	18
13	5	8	22	15	45	30	22	23	3	17
14	5	31	42	16	3	32	22	30	24	16
15	5	54	57	16	21	17	22	37	19	15
16	6	18	6	16	38	44	22	43	48	14
17	6	41	9	16	55	55	22	49	50	13
18	7	4	6	17	12	48	22	55	27	12
19	7	27	57	17	29	23	23	0	38	11
20	7	49	40	17	45	40	23	5	22	22
21	8	12	16	18	1	39	23	9	39	9
22	8	34	45	18	17	18	23	13	29	8
23	8	57	5	18	32	37	23	16	53	7
24	9	19	16	18	47	38	23	19	50	6
25	9	41	19	19	2	18	23	22	19	5
26	10	3	12	19	16	37	22	24	22	4
27	10	24	56	19	30	36	23	25	57	3
28	10	46	30	19	44	14	23	27	5	2
29	11	7	53	19	57	10	23	27	46	1
30	11	29	5	20	10	25	23	28	9	0
	♍ ♓			♌ ♒			♋ ♑			

The vſe of this Table is thus: If the Sunne be in any of the ſignes, ſet down in the front of the Table, then ſeeke his degrée (firſt found by the Ephemerides) in the left collume, the degrées whereof doe deſcend from one to 30. and the ſquare Angle anſwerable to that ſigne and degrée, will ſhew his declination. But if the Sunne be in any of the ſignes that are in the foot of the Table, then ſéeke his degrée in the column at the right hand, the degrées whereof doe aſcend, and the ſquare Angle anſwerable to that ſigne and degrée, will ſhew his declination.

There be other things alſo méet for Sea-men to know, touching the Sunne, as theſe: Firſt, to know the foure ſeaſons of the yeare: ſecondly, to know by his declination, the length of both the day and the night in euery latitude, & how it doth encreaſe and decreaſe. Item, to know in what rombe or winde, and at what houre he riſeth and ſetteth, and alſo his Meridian altitude, that is, when hée is right South euery day, to find out by the helpe of that, and by knowing his declination, the true Latitude of any place, and by his ſhadow to know the houre of the day, which are two chiefe points that the Mariner hath moſt néed to know. Of all which things I minde here to treat both plainely and briefly.

CHAP. XLVI.

Of the foure ſeaſons of the yeare, that is; Spring time, Summer, fall of the leafe, called otherwiſe Autumne, and Winter.

In this our Clime, ẏ ſpring is ſaid to begin when the ſun entreth into the firſt point of Aries, which is about the 11. of March, and continueth vnto the laſt point of Gemini, which time is ſaid to be hot and moiſt, and therefore is likened to childhood: And Summer beginneth when the Sunne entreth into the firſt point of Cancer, which is about the 12. or 13. of Iune, and endeth when he is in the laſt degrée of Virgo: and this time is ſaid to be hot and drie, and therfore is likened to Adoleſcencie. Then Autumne or fall of the leafe beginneth when the Sunne entreth into the firſt point of Libra, which is about the 13. or 14. of September, and endeth when the Sun is in the laſt degrée of Sagittarius: and this time is ſaid to be cold and drie, and therefore is likened to Manhood: Finally, Winter beginneth when the Sunne entreth into the firſt point of Capricorne, and endeth when he is in the laſt degrée of Piſces: and this time is ſaid to be cold and moiſt, and therefore is likened to old age: notwithſtanding Galen in his firſt booke de Elementis ſaith, that the ſpring is temperately hot and moiſt, and therfore a moſt holſome time: And Summer is more hot than cold, and more drie than moiſt, and therfore is ſaid to be hot and drie: And Autumne is alſo ſayd to be drie, becauſe it is more drie than moiſt, and yet neither hot nor cold, but vnequally mixt, and thereby infectiue, and cauſing ſickneſſe. And Winter is ſaid to be cold and moiſt, not becauſe it is colder, or moiſter, then any other ſeaſon, but becauſe that in Winter moiſture excéedeth dryneſſe, and coldneſſe exceedeth heat. But you haue to vnderſtand that theſe foure ſeaſons haue not like qualities in all the fiue Zones: For in the burnt Zone, and ſpecially to thoſe that dwell righ vnder the Equinoctial, the Sunne being in Aries or Libra, cauſeth greateſt heat, and therby two Summers, becauſe hee is then right ouer their heads, and being in either of the Solſtices, that is in the beginning of Cancer or Capricorne, he cauſeth two Winters, becauſe hee is then furtheſt from them, as I haue declared vnto you in the ſecond part of my Treatiſe of the Spheare the 20. Chapter, whereas I treat of the ſeaſons and ſhadowes incident to diuers Climes and Parallels, whereunto I referre you, and ſo I end with this matter.

CHAP. XLVII.

How to know when the Sun riſeth and ſetteth in euery Latitude, and thereby the length of the day and night, and alſo in what Rombe or Winde he riſeth and ſetteth, and how much he declineth euery day from the Equinoctiall, eyther Northward or Southward. Alſo how to know the eleuation of the Pole, otherwiſe called the Latitude of any place, by knowing the Meridian Altitude of the Sunne, & his declination.

The moſt part of all theſe things haue bin taught before in my Spheare, in my Treatiſe of the Globes, and alſo in my Treatiſe of the Aſtrolabes. And in the firſt two Treatiſes I ſhew alſo how to find out the Longitude of any place, and therefore néedeth not héere to bée rehearſed: But if you would know how to handle the declination of the Sunne, being vpon the Sea, then reade the 7.8.9. and 10. Chapters of William Bourne his Booke, called the Regiment of the Sea, and you ſhall bee fully inſtructed therein: The whole effect of all which Chapters, Robert Norman ſetteth downe in few words in his new Attractiue, in this manner as followeth.

Firſt, learne whether the Sunne haue South Declination or North declination, which you ſhall know by his being in any of the Northerne or Southerne ſignes: Then marke what ſhadow he caſteth, and whether it ſtriketh towards the Pole whereunto he is neareſt, or to the contrarie. For if the Sunne caſteth his ſhadow the ſame way that he is from the Equinoctial, he ſhalbe betwixt you and the Equinoctiall, and then hauing taken his Meridian Altitude, ſubtract the ſame from 90. & adde vnto the remainder the Suns declination for that day, & the ſum thereof ſhal be the eleuation of the Pole, or the diſtance of your Zenith from the Equinoctiall, called the latitude, which is alwayes equall to the eleuation of the Pole: But if the Sunne caſteth his ſhaddow to the contrarie ſide of the Equinoctiall, that is to ſay, being in his North declination, caſteth his ſhadow Southward, or being in his South Declination caſteth his ſhaddow Northward, then eyther the Equinoctiall ſhall be betwixt you and the Sun, or you in the Equinoctiall, or elſe, you ſhall be betwixt the Equinoctiall & the Sun, which you ſhall know thus: Adde the Declination of the Sun for that day, wherein you ſéeke vnto his Meridian altitude, and if the ſum of the addition bee leſſer then 90. degrées, then ſo much as it wanteth of 90. degrées, ſhall you be diſtant from the Equinoctiall on that ſide, on which ỹ ſhadow ſtréeketh: but if it amounteth iuſt to 90. degrées, then you ſhall be right vnder the Equinoctiall. Againe, if it be more then 90. degrées, then ſo much as is the ouerplus, ſo much ſhall you bée from the Equinoctiall towards the Sunne, at which time you ſhall be alſo betwixt the Equinoctiall and the Sunne. And if you find the Meridian altitude of the Sun to be euen with your Zenith, then lóoke what declination the Sunne hath at that inſtant, and ſo much ſhall you bee from the Equinoctiall on that ſide wherein the Sunne is: but if the Sunne hath no declination, then ſhall you be right vnder the Equinoctiall Line.

CHAP. XLVIII.

Of the ſhadow of the Sunne, and how to know thereby the houre of the day in any latitude, by help of an vniuerſall dial.

My former order now requireth that I ſhould ſpeake ſomewhat of the ſhadow of the Sunne, and of the diuerſitie thereof, according to the Clime or Parallel vnder which you ſayle. But for ſo much as I haue ſhewed you in the ſecond Part of my Spheare, from the 20. to the 27. Chapter of the ſame, what diuers ſhaddowes the Sun yéeldeth in diuers Climes and Parallels, and alſo haue ſhewed what Vmbra recta, & Vmbra verſa is in the 40. Chapter of my Treatiſe, of the Aſtrolabes, I minde not héere therefore to make a new recitall thereof, but onely to ſhew how you ſhall find by his ſhaddow the true houre of the day in euery Latitude by a generall Diall, made to ſerue in all latitudes, of which Dials, though I haue ſéene diuers and of diuers ſhapes,

yet none liketh me better then that which William Bourne ſetteth downe in his Regiment, the 21. Chapter, and calleth it the Equinoctiall Dyall, which ſerueth not only to know the houre of the day by the ſhadow of the Sunne, but alſo the houre of the night by the ſhadow of the Moone, when ſhee ſhineth cleare, which Dyall being of ſmall charge, I would wiſh all Mariners to haue. The making and vſe whereof is ſo plainely ſet downe by himſelfe in the foreſaid Chapter, as I thinke it ſuperfluous to ſet it downe againe here. And thus ending with the Sunne, I will now turne my pen to the Moone.

CHAP. XLIX.

Of the Moone and of all her diuers motions.

The Móone is a round thicke and darke body, hauing no light of her ſelfe, but onely ſuch as ſhe receiueth from the Sunne, and ſhe maketh her daily motion from Eaſt to Weſt, as all other ſtarres doe in 24. houres, according to the mouing of the Primum mobile: But according to her owne motion, which is from Weſt to Eaſt, ſhe goeth but 13. degrées, 12. minutes, in the ſpace of 24. houres, and that is according to her meane motion. And ſhe paſſeth through the 12. ſignes of the Zodiaque in 27. dayes and eight houres: during which time the Sunne by his naturall motion, which is alſo from Weſt to Eaſt, is remoued from the place of coniunction almoſt 27. degrées, ſo as the Móone not finding out the Sunne there, ſpendeth two dayes, foure houres, and 44. minutes more in ouertaking him, which being added to 27. dayes and 8. houres, doe make in all 29. dayes, 12. houres, and 44. minutes. Notwithſtanding by reaſon that the Moone hath aſwell as the Sunne thrée motions, that is, ſwift, meane, and ſlow, ſhe may change ſometime ſooner, and ſometimes later then in 29. dayes, 12. houres, 44. minutes, and yet one change counted with another, ſhall make vp the ſelfe-ſame Summe. And note, that this her thrée-ſold motion dependeth vpon two points, the one called the Auge, and the other the point oppoſite to the Auge.

The point Auge of the Moone is when ſhe is fartheſt diſtant from the earth, and the point oppoſite to that is, when ſhee is nigheſt to the earth: for when ſhe is in the point Auge, ſhe goeth little more then twelue degrees, in 24.houres: but when ſhe is in the oppoſite point, ſhe goeth almoſt 15.degrees, in 24.houres. And in her meane motion, which is in the middeſt betwixt the two foreſaid points, ſhe goeth 13.degrees, and 12. minutes in 24.houres.

Now becauſe the Mariners doe account the mouing of the Moone by the points of their Compaſſes, they may thereby vnderſtand that ſhe goeth not alwaies in 24.houres one point and three minutes as they reckon, but ſometime more, & ſometime leſſe: For when ſhe is in her ſlow motion, ſhe goeth little more then 12.degrees in 24.houres, in which time yͤ Sunne goeth one degree, ſo as the Moone is diſtant from the Sun but 11. degrees, which is but 44.minutes of an houre, which wanteth 4.minutes of a whole point, whereto is attributed 48. as hath been ſaid before: and in her ſwift motion ſhee goeth 15.degrees, in which time the Sunne goeth one degree, ſo as ſhe is diſtant from the Sunne 14.degrees, which is more then a point & three minutes of the Compaſſe. And you haue to note, that the point Auge of the Moone is moueable, & paſſeth through the Zodiaque in the ſpace of 19.yeeres, and thereby ſometime cauſeth the full of the Moone to happen ſooner or later.

CHAP. L.

How to know in what ſigne the point Auge of the Moone is in any yeere.

IF you would know in what ſigne the Auge of the Moone is in any yeere, then you muſt conſider the Prime or Golden number of that yeere, for when the Prime or golden number is one, then her Auge is in Aries. And if yͤ moone be alſo thē in Aries, ſhe is in her ſlow motion: and being in the point oppoſite, which is ♎, ſhe is in her ſwift motion. And ſith this Auge of the Moone goeth through the twelue ſignes in 19.yeares, as hath been ſaid, it muſt needs fall out that in 9.yeares and a halfe her Auge commeth to be in Libra: And then the Moone being there, ſhe is in her ſlow motion: And being in the point oppoſite, which is Aries, ſhe is in her ſwift motion. Againe, when the Prime is 5. then her point Auge is in Cancer: and the Moone being there, ſhe is in her ſlow motion, and when ſhe commeth to bee in the point oppoſite, which is Capricorne, ſhe is in her ſwift motion: And when the Prime is 14. or 15. then her point Auge is in Capricorne, where if the Moone be alſo, then ſhe is in her ſlow motion: and being in the point oppoſite, which is Cancer, ſhee is in her ſwift motion. And note when the Moone is in her ſwift motion, ſhe maketh her change or full, or any other aſpect the ſooner: And contrariwiſe when ſhe is in her ſlow motion, ſhee maketh her change, or full, or any other aſpect the later. Moreouer, you ſhall ſee her at the time of her change, either ſooner or later, according to the time of the yeare, for from Ianuary to Iune you ſhall ſee her within 24.houres after her change, becauſe ſhee hath, during thoſe months, North declination from the Sunne, and maketh a greater arch then the Sunne doth. But from Iuly to December, you ſhall not ſee the Moone ſcant three daies after the change. But you may ſee her within 24. houres before her change, becauſe that during thoſe moneths ſhe hath South declination from the Sunne: And note that when the Moone is three daies & 18.houres, which is the halfe quarter of the Moone, the Sea-men doe call that time the Prime day, becauſe the Moone is then 4.points to the Eaſtward of the Sunne, which is three houres, for to euery point is attributed three quarters of an houre, as hath beene ſaid before. Moreouer, it is neceſſarie for Sea-men to know when the Moone riſeth and ſetteth, and in what part of the Horizon in euery Latitude: and how long ſhe ſhineth, and when ſhe is full South, and alſo what Latitude ſhe hath, and whether it bee South or North, euery day and houre throughout the yeare. All which things are moſt eaſie to be found by the Globe, and by helpe of the Ephemerides, in ſuch ſort as is before taught in my Treatiſe of the Globes, and alſo by helpe of M. Blagraue his Aſtrolabe, her true place in the Zodiaque being firſt knowne by the Ephemerides. It is meet alſo to know when ſhe is in Coniunction with the Sunne, or at the full, and the reſt of her quarters, which is eaſily knowne by the Ephemerides.

CHAP. LI.

When the Moone is ſaid to be in Coniunction with the Sunne, or to be at the full, and what her greateſt latitude is, as well from the Ecliptique line, as from the Equinoctiall.

SHe is ſaid to be in coniunction with the Sunne, when the Sunne and ſhe be both in one ſelfe ſigne and like degree: But when ſhe is at the full, then ſhe is appoſite to the Sunne, & diſtant from him ſixe ſignes, which is ẏ one halfe of the Zodiaque, containing 180. degrees: And in euery quarter ſhe is diſtant from the Sunne three ſignes, which is 60. degrees: Moreouer, the Moone is ſaid to haue Latitude both Northerne and Southerne from the Ecliptique line, which line the different of the Moone croſſeth in two points, and thereby maketh two interſections, whereof the one tending towards the North, is called the head of the Dragon, and the other interſection towards the South, is called the taile of the Dragon, ſo as when ẏ Moone is paſſed 90. degrees from ẏ Dragons head towards the North, then her Latitude is fiue degrees Northward: And when ſhe is diſtant 90. degrees, from the taile of the Dragon towards the South, then her Latitude is alſo 5. degrees Southward, which is the greateſt Latitude that ſhe hath on either ſide of the Ecliptique line, whereof I haue written more at large in the firſt part of my Spheare, the 15. Chapter, in which you ſhall find a figure repreſenting the ſaid Dragon both head and taile: But her Latitude is to be conſidered in two reſpects, that is, not only from the Ecliptique line, but alſo from the Equinoctiall, for from the Ecliptique line her greateſt Latitude is but 5. degrees on either ſide of the Ecliptique, as hath beene ſaid before. But from the Equinoctiall her greateſt Latitude is 28. degrees and a halfe, on either ſide of the Equinoctiall, which in mine opinion might be more rightly called her greateſt declination, which exceedeth by 5. degrees the declination of the Sun, for that is but 23. degrees and a halfe, or rather 28. on either ſide of the Equinoctiall. But this great Latitude of the Moone is onely to be vnderſtood when the Prime is one, and that her Auge is in Aries: For when the Prime is betwixt 9. or 10. yeares or more, the Moone declineth not from the Equinoctiall on either ſide aboue 18. degrees, and a halfe, at the moſt.

CHAP. LII.

How to know in what part of the Zodiaque the head of the Dragon is euery yeare.

IF you would know in what part of the Zodiaque the head of the Dragon is, then you muſt conſider the Prime, for when the Prime is one, then the Dragons head is in ẏ firſt point of Aries, euen as the point Auge is. And in 19. yeares it paſſeth through the twelue ſignes aſwel as the point Auge of the Moone, but with contrarie courſe, for the point Auge of the Moone moueth according to the ſucceſſion of the ſignes, that is, from Aries to Taurus, Gemini, and ſo forth: but the head of the Dragon hath a contrarie motion, that is, from Aries to Piſces, and ſo into Aquarius, and ſo forth, ſo as in nine yeares and a halfe, it meeteth iuſt with the point Auge of the Moone in the ſigne Libra. Thus you ſee that by knowing the Prime, you learne alſo to know in what ſigne the Auge of the Moone, and alſo the Dragons head is, and what Latitude the Moone hath, aſwell from the Ecliptique line as from the Equinoctiall. But one of the chiefeſt points to be had by the Moone, is to know thereby the Tides, that is, when the Sea floweth and ebbeth in any place: whereof we come now to ſpeake.

Chap. LIII.

How to know the Tides in any place by the Moone.

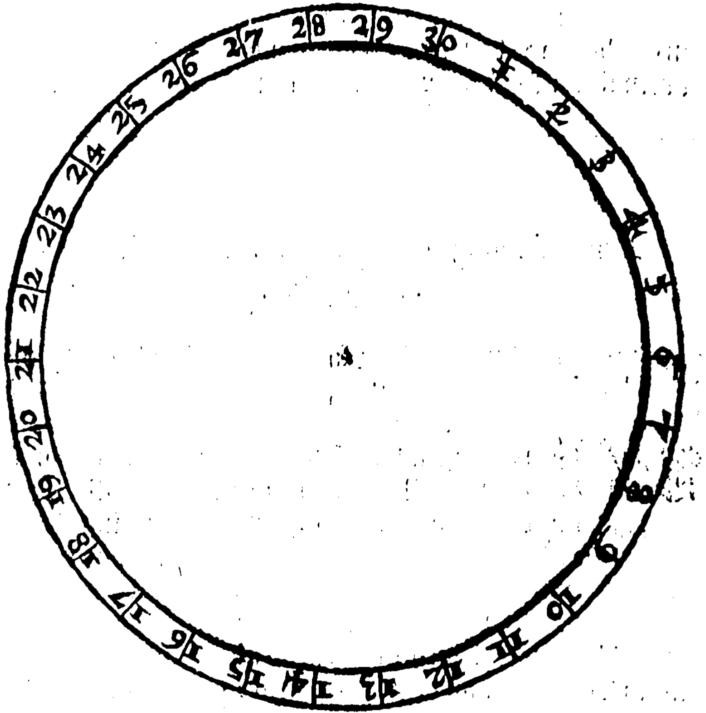
Before that you enter into any Hauen or Riuer, it is neceſſarie to know the true tides of that place, which tides are ſubiect to the motion of the Moone, for ſhe cauſeth at one place or other alwaies in one certaine rombe, full Sea. As for example, it is alwaies full Sea at Antwerpe, when the Moone is either right Eaſt or Weſt: and it is ebbe or low water there, when ſhe is North or South, and becauſe the Moone doth paſſe through all the rombs of the Mariners Compaſſe in 24. houres, they allow to euery rombe ¾. of an houre, which is 45. minutes, and that being multiplied by 32. doe make iuſt 24. houres, wherefore if the two rombs, North and and South, doe yeeld each of them 12. houres, then the firſt rombe muſt needs yeeld ¾. of an houre, the ſecond, one houre and ½. and the third, two houres and ¼. and ſo forth, of the reſt: For by adding to euery rombe ¾. you ſhall find that the Eaſt and Weſt doe yeeld alwaies 6. houres: but then you muſt note that according to the age of the Moone, the Tides doe fall euery day later and later, wherefore to know the true time of the Tide in any place, you muſt firſt learne by ſome Rutter, or by the relation of others that can tell in what rombe the Moone cauſeth full Sea in that place, and then at what houre it is full Sea, the Moone being either in the change or at the full; which you ſhall know by allowing to euery rombe ¾. of an houre, in ſuch manner as is before ſet downe. But if you would know at what houre it is full Sea in that place euery day, then you muſt firſt vnderſtand that the Moone in 30. daies ſlacketh 24. houres, which amounteth to ⅘. of an houre, which is 48. minutes for euery day, for ſo much ſhe declineth euery day from the Sunne, then looke how many daies the Moone is old, and hauing multiplied the ſame by ⅘. that is to ſay, by 48. minutes, adde the product thereof to thoſe houres, at which it is full Sea, and you ſhal haue the true time of full ſea euery day; As for example, ſuppoſe that it was full Sea at the laſt new-Moone, at ſome place here in England at three of the clock in the afternoone, & now I would know at what a clocke it ſhall be full Sea fiue daies after the new Moone. Now if you multiply 5. being the age of the Moone by 48. minutes, and adde to the product thereof three houres, which was the time of the laſt change, the full Sea ſhall be at that place at ſeuen of the clocke. But if the ſumme of ſuch addition be aboue 12. houres, then you muſt caſt away the 12. and the remainder ſhall ſhew you the true houre of full Sea.

Chap. LIIII.

How to know by helpe of an Inſtrument the Tides at any place.

There is alſo an eaſier way to know the Tides euery day in any place, by the helpe of an Inſtrument, ſet downe by Cogniet, whereof both the making and vſe here followeth. Firſt vpon ſome board well plained and made ſmooth, draw a circle, and diuide the ſame into 30. parts, ſignifying the dayes or age of the Moone, ſetting the number of 30. aboue in the top of the Inſtrument, and place all the other numbers, as 1.2.3. and ſo forth, towards your right hand, that done, make a mooueable rondle which may turne about within the verdge of the firſt Circle, and diuide that into 24. houres, and alſo into 32. rombs, ſetting the North point marked with the Flowerdeluce at the twelfth houre aboue, and the South point at the twelfth houre beneath; and the Eaſt point at the ſixth houre on your right hand, & the Weſt point at the ſixth houre on your left hand, and ſo ſhall your Inſtrument be perfect, the vſe whereof is thus:

Firſt, you muſt know what rombe or point of the compaſſe being vpon the Moone in that place which you ſeeke maketh a ful Sea, and alſo the age of the Moone by ſome Almanacke, or ſome other rule before taught, then hauing theſe two things, turne the inward rondle of the houres & rombs, vntill the foreſaid knowne rombs doth iuſtly anſwere to the 30. day of the great rondle, and there ſtaying it firme with your finger, ſeeke in the outermoſt border of the greater rondle the age of the Moone, and that will ſhew you in the rondle of houres, the very houre of full Sea that day in that place.



But one chiefe thing touching the knowing of the Tides, is to be noted as Bourne ſaith, which is, that the Sea will flow more by one point of the Compaſſe in the ſpring-tides, then in any of the quarters of the Moone, called Nep-tides, in euery Riuer, that hath any indraft, and is of ſome reaſonable diſtance from the Sea: As for example, it floweth at Graues-end at the change or full of the Moone, when ſhe is South South-weſt, but in any of her quarters it ſcant floweth when ſhe is South and by Weſt, and this rule, as he ſaith, is generall for euer.

CHAP.

CHAP. LV.

How a generall Rutter ſhewing the tydes in all places ſhould be made.

William Bourne doth ſet downe what Moone doth make a full Sea, as well heere in the moſt parts of our Engliſh coaſts as in ſome other parts of France and Spaine, and ſo doe many others, whoſe Tables touching the Tides are called Rutters, whereof ſome are truely ſet downe and ſome are falſe: But ſith ſuch Rutters doe ſerue but for a few particular places, I would wiſh that ſome learned Pilot that hath ſailed many, and ſundry long voyages, to make a generall Rutter that might ſerue for all places if it were poſſible, or at the leſt for ſo many places as are knowne in theſe daies: And I would wiſh ſuch a generall Rutter to be made in manner of an Alphabet: And that euery place might haue his true Longitude and Latitude added thereunto, to the intent that euery place might be the more eaſily found out in any Map, or Card, that is graduated with degrees of Longitude and Latitude: And then to ſhew what Moone doth make a full Sea in euery ſuch place, which thing whoſoeuer would performe, he ſhould in my opinion deſerue great commendation. And thus I end this Treatiſe, praying all the learned Sea-men not to be offended or grieued with me, for that I doe make yong Gentlemen, our owne Countrimen, pertakers of their moſt worthy knowledge, whereof the ignorant are not able to iudge, nor to yeeld them that praiſe which they deſerue: yea, rather I hope they will helpe to perfect whatſoeuer I haue heerein left vnperfected, to make the young Gentlemen the more skilfull, and thereby the more ſeruiceable to their Country, and in ſo doing they ſhall procure to themſelues great good will and infinite thankes.

A BRIEFE DESCRIPTION OF VNIVERSALL *Maps* and *Cardes*, and of *their vſe.*

And alſo the vſe of *Ptolomey* his Tables, *together with the true order of making* the ſayd Tables.

And of all other Maps *and* Cardes, *aſwell* vniuerſall as particular, and that according to the doctrine of the beſt *Geographers* that be, or haue bin in theſe latter dayes.

LONDON,
Printed by WILLIAM STANSBY. 1621.

Certaine Termes of Coſmographie, briefely expounded, for thoſe that are not learned in that Science, to the intent they may the better vnderſtand this Treatiſe.

The Axletrée of the world.

The two poles.

The Axletrée of the world is a right line, imagined to paſſe through the Centre or midſt of the earth, from the one end of heauen to the other: the vpper end of which Axletrée is called the Pole Articke, that is to ſay, the North Pole: and the nether end, the Pole Antartike, that is, the South Pole: vpon which two Poles, otherwiſe called the hookes or hengils of the world, the heauens doe turne round about the earth, and this Axletrée ſignifieth alſo the firſt Meridian. Moreouer the Coſmographers doe diuide the world into diuers parts by certaine Circles, whereof ſome are called greater, and ſome leſſer.

The greater Circle.

The greater are thoſe which doe diuide the world into two equall parts, whereof there be ſix: that is, the Equinoctiall, the Zodiaque, the Meridian, the Horizon, and the two Colures.

The Equinoctiall.

The Equinoctiall is a great Circle, girding the world in the very midſt betwixt the two Poles, by reaſon whereof there are two Latitudes, the one Northerne, and the other Southerne.

The North Latitude.

The Northerne Latitude is that ſpace which is contained betwixt the Equinoctiall and the North Pole.

The South Latitude.

The Southerne Latitude is that ſpace, which is contained betwixt the Equinoctiall and the South Pole, and either of theſe two ſpaces containeth in breadth 90. degrées.

A degrée is one part of a Circle, being diuided into 360. parts called degrées.

Againe, the circuit of the Equinoctial, containing 360. degrées is the very Longitude of the earth: the firſt degrée of which Longitude beginneth at the firſt Meridian placed in the Weſt, and ſo procéedeth Eaſtward vnto the 180. degrée of the Equinoctiall, and from thence returneth by the Weſt vntill you come a-

gaine

gaine to the 360. degrée, which is the laſt degrée of Longitude. And note by the way, that euery degrée of the Equinoctiall containeth 60. Engliſh miles, ſo as the Longitude of the whole earth is 21600. miles.

The Zodiaque is a great, broad, and ſlope, or ſhoring Circle, carrying the 12. ſignes: in the middeſt whereof is a line called the Ecliptique line from which the Sunne neuer ſwarueth.

The Meridian is a great Circle, paſſing ouer our heads, in what part of the world ſoeuer we be, and alſo through both the Poles: which line when the Sun toucheth it aboue the Horizon, it is noonetide or midday to thoſe that dwell vnder the ſame.

The Horizon is a great Circle, diuiding the vpper halfe of the world which ſée, from the nether halfe which we ſée not: in the very middeſt or Centre of which Circle, if in a plaine field you looke round about you, you ſhall alwaies find your ſelfe to be.

Now as touching the two Colures, becauſe they differ not in effect, though in name, from two Meridians, I leaue to ſpeak of them, aſwell for that I haue ſpoken of them at large in my Spheare as alſo, for that they are not mentioned in this treatiſe.

Of the leſſer Circles, there by foure: that is, the two Polar Circles, and the two Tropikes. Of the two Polar Circles, the one enuironeth the North Pole, and therefore is called the Circle Articke, and the other enuironeth the South Pole, and is called the Circle Antarticke, becauſe it is oppoſite to the other.

Againe of the two Tropickes, the one is placed betwixt the Equinoctiall and the Circle Articke, and is called the Tropicke of Cancer, and the other is placed betwixt the Equinoctiall and the Circle Antarticke, and is called ẏ Tropicke of Capricorne, and each of theſe Tropikes is diſtant from the Equinoctiall 23. degrees and a halfe, which is the greateſt declination of the Sunne from the Equinoctiall, for hee neuer mounteth higher then the Tropicke of Cancer, nor deſcendeth lower then the Tropike of Capricorne, and theſe two Circles are Parallels to the Equinoctiall.

Parallels are two lines or Circles, equally diſtant in all places one from an other. And by theſe foure leſſer Circles ẏ earth is diuided into fiue Zones or broad ſpaces, whereof there bee two colde, two temperate, and one hot, deſcribed both in my Sphere, and alſo in this Treatiſe.

A Parallel of the longeſt day, is a ſpace of the Earth wherein the day increaſeth by one quarter of an houre, procéeding from the Equinoctiall towards any of the Poles.

A clime is a ſpace of the earth, containing two ſuch parallels wherein the day increaſeth by halfe an houre, of which Climes according to the old Writers, there be ſeuen declared at the full in my Spheare, and alſo ſomewhat touched in this Treatiſe.

A briefe deſcription of vniuerſall Maps and Cards, and of their vſe, and alſo of the vſe of Ptolomey *his Tables.*

This word Mappa in Latine ſignifieth a Table-cloth of linnen to couer a board: of the ſhape and likeneſſe whereof vniuerſall Tables, contayning the deſcription of the earth, are commonly called Maps. And firſt you haue to vnderſtand, that euery ſuch Map is chiefly traced with two ſorts of Lines or Circles, that is Meridian and Parallels. The Meridians are either right or circular Lines paſſing through both the Poles of the World, and are imagined to be drawne right vp and downe from the head to the foote of the Map, and are called Meridians, of this Latine word Meridie, which is as much to ſay as midday or noonetyde. Becauſe that when the Sunne commeth to touch any of thoſe lines, it is midday to thoſe that dwell right vnder the ſame. Againe, Parallels are either right or circular lines, imagined to be equally diſtant one from another, which do croſſe the foreſaid Meridians with right Angles. Now in the very midſt of the Map is moſt commonly drawne from head to foote a right line, which ſignifieth not only the firſt Meridian, but alſo the Axletrée of the world, the vpper end of which line is called the Pole Artique, that is to ſay, the North Pole, and the nether end, the Pole Antarctique, that is the South pole, and this line is croſſed in the very midſt betwixt the two poles, with another great Circle or right line called the Equinoctiall, becauſe that when the Sunne

commeth

commeth to touch this line or Circle, the day and night is equal through the world. The one halfe of which line towards the right hand ſheweth the Eaſt part: and the other halfe towards the left hand ſheweth Weſt part of the World: ſo as theſe two lines, the firſt Meridian, and the Equinoctiall, doe point out the foure quarters of the World, North, South, Eaſt, and Weſt, from whence the foure principall Windes doe blow, betwixt which Winds are ſet downe in moſt Maps, together with their Latine or Italian names in the outermoſt ſkirt or border thereof, eight other Windes, ſo as in all there be 12. Winds, whereby the ancient Greekes and Romanes were wont to ſaile. The names whereof, both Greeke, Latine, and Engliſh, are heeretofore ſet downe in the latter end of my Spheare.

But now to returne to our firſt two lines, that is, the firſt Meridian and the Equinoctial, you haue to note, that both theſe lines or Circles are diuided each of them into 360. degrees, ſo as euery quarter of them containeth 90. degrees. And in the Equinoctiall are ſet downe the degrees of Longitude, which is the length of the World round about, from Weſt to Eaſt, and againe, from Eaſt by Weſt home againe: The firſt degree whereof beginneth, whereas the firſt aforeſaid Meridian croſſeth the Equinoctiall in the very midſt of the Map, and ſo proceedeth Eaſtward vnto the number of 180. degrees, which is as farre as you can go Eaſtward, ſith from thence by reſon of the roundnes of the Earth, you muſt neede turne backe againe Weſtward, vntill you come to the 360. degree, which is the laſt degree of Longitude, and endeth where the firſt degree beginneth.

Moreouer, in the ſaid firſt Meridian, or in ſome other Meridian, & hard by it, are ſet downe the degrees of Latitude, that is to ſay, in breadth of the World both Northerne and Southerne: for from the Equinoctial to the North Pole are contained in the foreſaid Meridian 90. deg. & that is called the North Latitude, and from the Equinoctiall to the South Pole, are contayned in the ſaid Meridian, other 90. degrees, which is called the South Latitude: and in moſt Maps, the Equinoctiall line is diuided and croſſed with 18. Meridians on each ſide of the firſt Meridian diuidign the Equinoctiall into 36. ſeuerall ſpaces or diſtances, euery

euery ſpace, containing 10. degrees, and euery degree containeth 60. Italian miles of length.

Moreouer, betwixt the Equinoctiall & each of the Poles, are drawne certaine circles or lines, called (as I ſaid before) Parallels: of which moſt commonly foure are painted with red Inke, ſignifying the foure leſſer Circles before deſcribed in my Spheare, whereof the higheſt towards the North Pole, is called a Circle Articque, being diſtant from the Pole 23. degrees and a halfe, and the loweſt towards the South Pole, is called the Circle Antarticque, being alſo diſtant from the Pole 23. degrees and a halfe: or rather 23. degrees 28. for that is the greateſt declination of the Sunne at this preſent.

Now as touching the other two red Circles, the one lying betwixt the Circle Articque & the Equinoctiall, is called the Tropicke of Cancer, & the other lying betwixt the Equinoctiall and the circle Antarticque, is called the Tropick of Capricorne, and each of theſe two Tropiques is diſtant frõ the Equinoctiall 23. degrees and 28. which is the greateſt declination of the Sunne, for betwixt theſe two Tropiques, the Sun continually maketh his courſe & returne, as this word Tropique ſignifieth, mounting neuer higher then the Tropique of Cancer, nor deſcending lower then the Tropique of Capricorne: for which cauſe ſome do ſet downe in their Maps, betwixt the ſaid two Tropiques an ouerthwart line, ſignifying the Ecliptique line, vnder which the Sunne continually paſſeth. Now by helpe of the foreſaid foure Circles, the earth is diuided into 5. Zones, that is, one hot, two temperate, and two cold. The hot is contained betwixt the two Tropiques, in the midſt of which hot Zone, is the Equinoctiall line, and of the two Temperate Zones, the one lieth betwixt the Tropique of Cancer & the Circle Articque, and the other betwixt the Tropicke of Capricorne, and the Circle Antarticque.

Againe, of the 2. cold Zones, the one lyeth betwixt the North Pole and the Circle Articque, and the other betwixt the South Pole and the Circle Antarticque. Now beſides theſe foure ſpeciall Parallels, there be diuers other Parallels drawne on each ſide of the Equinoctiall, both Northward & Southward, which croſſing in certaine points, the firſt Meridian marked with degrées do ſhew the true Latitude of euery place, and vnder what Clime or Parallel it is, and alſo how many houres the longeſt day of any place vnder euery parallel is, beginning to accompt the ſame, either from the Equinoctiall vpward towards the North pole, alongſt the firſt Meridian, marked with degrées of Northerne Latitude, or elſe from the ſaid Equinoctiall downeward towards the South pole, marked with degrées of Southerne Latitude.

Notwithſtanding they vſe moſt commonly to ſet downe the number and iuſt diſtances of the Climes, Parallels, and houres in the North Latitude only, willing the like number of Climes, Parallels, and houres to be accounted in the South Latitude, euen as they are in the North Latitude, and with like diſtances. And note that in procéeding towards the Pole from the Parallel, whereas the longeſt day is 24. houres, they accompt the Parallel of the longeſt day, no longer by houres, but by moneths, that is to ſay, from one moneth to ſixe moneths, whereof we haue ſpoken before in our Spheare. The numbers of the foreſaid Climes, Parallels, and houres, you ſhall find ſet forth in Vopellius Map, alongſt the firſt Meridian on the left hand. But he ſetteth downe the numbers of the longeſt daies, increaſing by moneths in the vttermoſt border of this Map, on the right hand betwixt the North pole & the Circle Articque. And in that border he ſetteth downe the number of leagues and miles, anſwerable to euery Parallel, whereas alſo he ſheweth the thrée differences of Inhabitants according to their ſhadowes, that is to ſay, the Periſcij, Heteroſcij, and Amphiſcij.

Vopellius, his Map.

Periſcij, are thoſe that dwell in any of the two colde Zones, whoſe ſhadow goeth round about them.

Heteroſcij, be thoſe that dwell in any of the two temperate Zones, whoſe ſhadow tendeth at noontide but one way, that is either North or South.

Amphiſcij, be thoſe that inhabite the hot Zone, whoſe ſhadow tendeth both waies, that is, ſometime North, and ſometime South, as is before declared at large in my Spheare.

But in the Map of Gemma Friſius, you ſhall find all theſe things ſet forth on the left hand of his Map, amongſt the vttermoſt Circles, whereas vpon the Circle Artique, he ſetteth downe the twelue ſignes, hauing certaine compaſſed lines, running downe to the Equinoctiall, méeting and concurring all in one point, at the end whereof vpon the Equinoctiall, you ſhall find the number of houres, at which the Sunne riſeth in euery degrée of Latitude.

The Map of *Gemma Friſius*.

Alſo at the nether end of his Map on the left hand, he placeth a halfe quadrant, which he calleth, Directorium nauticum, whereof we ſhall ſpeake hereafter.

And becauſe he would haue his Map to ſerue both Sea and Land, hee ſetteth downe a certaine number of Mariners Compaſſes, diuided with 32. lines, ſignifying the 32. windes, which doe ſhew how euery place beareth one from the other, and by what winde a Ship is to be directed from one part to an other, which thing is alſo obſerued in Mercators Map and others that haue written more lately, and yet nothing ſeruiceable for the Sea, becauſe (as M. Borough, Controller of her Maieſties Nauie, a man moſt ſkilfull in the Art of Sayling, ſaith) no conſideration is had in the ſaid Maps or Cards, touching the variation of the Compaſſe, without the which they can neuer ſet downe any true or iuſt direction.

Now as touching the diuiſion and order of the parts of the Earth, moſt commonly deſcribed in vniuerſall Maps, you ſhall vnderſtand that the ancient Coſmographers, not knowing then the Weſt Indies, nor many other places ſituated both Northward & Southward (which haue bin ſince diſcouered) diuided the whole Earth onely into thrée parts, that is, Europe, Affrike and Aſia, in the deſcription whereof, their Maps neuer extended in Latitude Northwards, further then to 63. degrées, as I haue ſaid before in my Spheare, and Southward no further then to 16. degrées of Southerne Latitude, or there about, but in Longitude from Weſt to Eaſt, beginning ẏ ſame at the Ilands called Inſulæ Canariæ, or Fortunatæ, which are ſituated at the Weſt end of Affrike, in the Sea called Mare Atlanticum, their deſcriptions doe extend to 180. degrées. But becauſe a whole world almoſt hath bin found out ſince thoſe times, our moderne

Coſmographers, doe diuide the whole earth into foure parts: that is, Europe, Affrike, Aſia, and America, which we now call the Weſt Indies. And becauſe men of diuers Nations haue ſailed round about the world, Eaſt and Weſt, their late deſcriptions doe extend in longitude to the whole content of the Equinoctial, which is 360. degrees: and in Latitude Northwards, the ſame deſcriptions doe extend to 84. degrées: and Southwards, to 66. ½. as you may ſée in the vniuerſall Maps lately ſet forth by Mercator, and by Barnardus Puteanus, and more lately by Ianſonio and others.

The Map of *Mercator* and of *Barnardus Puteanus.*

But the ancient & moderne doe greatly differ in the diuiſion of the parts of Latitude, aſwell Northerne as Southerne, and alſo in Longitude: for, whereas the ancient Coſmographers doe diuide each Latitude into 90. degrées by certaine parallels, making 9. equall ſpaces, euery ſpace containing 10. equall degrées: in the latter Maps laſt mentioned, you ſhall finde thoſe ſpaces next the Equinoctiall onely excepted, for thoſe differ not aboue one halfe degrée at the moſt, but from thence Northward, euery ſpace is greater then other, and euery degrée, in euery ſuch ſpace is greater then other, in ſo much as the fourth ſpace containeth 11. degrées, and a halfe of thoſe degrées, which are ſet downe in the firſt ſpace, and the fift ſpace containeth of ſuch degrées 13. degrées ½. the 6. ſpace containeth of the ſaid degrées, 16. degrées ½. the ſeuenth containeth of the ſame degrées, 23. degrées ½. ſo as that ſpace is twice ſo broad as the firſt ſpace one halfe degrée more: the 8. ſpace containeth of the ſaid firſt degrées, 36. further then which 8. ſpaces containing 80. degrées of Latitude, their Maps extend not Northward: and they obſerue the like proportion in the Southerne Latitude, ſauing that they extend no farther Southward then to 66. degrées and a halfe.

Againe, they differ in Longitude thus: for the moderne Coſmographers do make the firſt meridian to paſſe through the Iles called Azores, which doe ſtand 5. degrées more Weſtward then the Fortunate Ilands do: through which Fortunate Ilands, Ptolemie and his followers doe appoint the firſt Meridian to paſſe.

The cauſe of which tranſporting the ſayd firſt Meridian, is becauſe that the Mariners Compaſſe doth neuer ſhew the right

North.

North, and South, in any other place, but only vnder that Meridian. Yea M. Borough thinketh ỷ it would ſhew it more truly, if the ſaid Meridian were placed ſomwhat more Weſtward. But in theſe Cards and Maps, that are made according to the rules of Ptolomie: the ſpaces of Parallels containing the 90. degrées of Latitude, both Northward and Southward, are equall, and all the degrées of euery ſuch ſpace, are alſo equall. And yet the ſpaces of Parallels, that ſhew the longeſt day in any place, are toward the Pole, euery one more narrow than other: for as I haue ſaid before in my Spheare, there are thrée kinds of Parallels, that is, Parallels of the Sunne, Parallels of the Latitude, and Parallels of the longeſt day. The cauſes why in theſe latter Maps, the degrées of latitude are made greater and greater towards the Poles, are ſet downe by Barnardus in his vniuerſal Map, who ſaith there, that in making the ſaid Map, he had thrée ſpeciall cares: Firſt, that the places might be ſo ſituated, as they may haue both true direction and diſtance, and alſo due longitude and latitude, & as nigh as may be, the ſame very ſhape which they haue in the Spheare or Globe, to which end he hath inuented a new proportion or habitude of the Meridians to the Parallels, affirming that the Maps before made, are not fit for Nauigation, by reaſon of the crookedneſſe and bowing of the Meridians, which by the oblique & ouerthwart falling into the Parallels, doe ſo much diſfigure in the vttermoſt parts, the true ſhape of the Regions, as they can ſcant bee knowne. And as for the Mariners Cards, becauſe their Parallels of latitude are alſo of equall diſtance from the Equinoctiall to the very Pole: hée ſaith that they muſt néeds miſfaſhion the Regions, and make the directions, diſtances, longitudes, and latitudes, to be vntrue, and thereby cauſe great errours. Which to auoide, he maketh the ſpaces of his Parallels and degrées of latitude, to increaſe by little and little towards the Pole, affirming that thereby all places ſhall haue their true ſhape, and alſo their true directions, diſtances, longitudes, and latitudes.

His ſecond care was, that the regions & places might haue their true quantitie and greatneſſe, and alſo true diſtance one from another, wherein he hath taken as he ſaith, greateſt paines

whileſt

whileſt he did conferre the Cards and Tables of the Caſtillians and Portugalls, aſwel amongſt themſelues, as with diuers other Nauigations both printed and written. His third care was to ſhew what parts of the world were knowne to the ancient men, that the limits and bounds of their Geographie might not be vnknowne, to the intent they might haue their due honor and praiſe. And hauing ſhewed what places they did in their time deſcribe, both Eaſt, Weſt, North, and South, in the end of his ſpeech, he affirmeth, that the ancient Coſmographers haue ſet downe in the Eaſt Indies, more places than euer the Portugalls haue as yet diſcouered or attained vnto.

This Barnardus Puteanus borne in Bruges, is, by his owne confeſſion, a Cutter or Grauer in braſſe, and alſo a Coſmographer, whoſe Map ſet forth in the yeere of our Lord 1579. doth not differ in any one point, that I can find, from the laſt vniuerſall Map of Mercator that famous Coſmographer, who, as I vnderſtand, was himſelfe alſo ſometime a Cutter and Grauer of ſuch Maps and Globes, as Gemma Friſius did cauſe to be printed in his time, from whom Mercator learned great part of his moſt excellent ſkill in Coſmographie.

Truly, when I did firſt behold theſe latter Maps, and ſaw that the Parallels towards the Pole were as long as the very Equinoctiall it ſelfe, it ſeemed to mee ſomewhat ſtrange, for then I ſaid, that a ſhip in ſayling about the world vnder the parallel of 60. degrees, ſhould by this meanes make as long a voiage as that which ſaileth about the world right vnder the Equinoctiall, which voiage is twice as long. For this containeth in Longitude 21600. miles, which is the whole compaſſe of the earth and the other containeth in longitude 1080. miles, which is iuſt halfe ſo much, no more. But after I had taken better aduiſement thereof, I found by meaſuring with my Compaſſe, that one degree of the Meridian next to the 60. degree of latitude, did comprehend two of ſuch degrees, as are ſet downe in the Equinoctiall, and that one degree of the Meridian, croſſing the parallel that hath 70. degrees of latitude, did comprehend three degrees of the Equinoctiall line, & ſo I found the degrees towards the pole to waxe greater and greater, by which degrees I perceiued

their meaning was, to haue the longitude of their parallels to be meaſured, and not by the degrees of the Equinoctiall. And by that meanes their Parallels ſhould haue each one as nigh as might be to his due Longitude proportionally, euen as they haue in the Globe.

Moreouer, the ſhape, quantities, and diſtances of ſuch Countries, as haue beene found out of late daies, muſt needs be more perfectly ſet forth in theſe Maps, then in thoſe that haue beene made heretofore, becauſe the true longitudes and latitudes of thoſe places were not ſo well knowne then as they are now. Albeit, I feare me, that of many places in the Indies, there are as yet but few longitudes knowne. For it is not ſo eaſie a thing to get the true Longitude of euery place, as the true Latitude thereof. And had not the late makers of Maps beene greatly holpen by the Maps and Cards of ſuch learned Pilots, as haue trauailed thoſe Countries, I doubt not, but that they ſhould haue committed as great errours as thoſe that wrote before them. And of one thing I doe aſſure my ſelfe, that in theſe latter Maps, more places are deſcribed, then euer were knowne or diſcouered: as for example, the North parts of Groyneland, Crockland, Greenland, and America, all which they make Iſlands, and yet neuer ſailed about them, and ſpecially on the North ſide, as it may bee well gathered by the vaine attempting of diuers Nations, to find out new wayes in the North Sea, to the Moluccas, both by Eaſt and Weſt. For being a little entered into thoſe Seas, they are quickly driuen backe, either by extreme cold, by great yces, or by the raging flouds bred of ſnow, and falling from the mountaines of the next continent, and making in ſome places ſuch whirlepooles in the Sea, as if any ſhip chance to come nigh them, it is ſoone ſwallowed vp.

Neither doe I thinke, that King Arthur in his time euer ſent (as it is reported) any of his People to inhabite thoſe Iſlands, being places, in mine opinion, more meet for Whales and monſtrous fiſhes to dwell in, then for men: and ſpecially for Engliſh men, which are not able to ſuffer yͤ cold Winter at Wardhouſe, to which place ſome of our mariners doin ſeile ſummer ſeaſon euery yere. And yet Wardhouſe hath ſcant in latitude ſeuenty one degrées; much leſſe then are they able to Winter in thoſe places that haue ſeuenty ſeuen degrées of Latitude, as the North ſide of Groynland, and Crockland hath. Moreouer, the North ſide of the Promontorie. Tabin hath 76. degrées of Latitude, which place, whatſoeuer Plinie ſaith thereof in his fourth Booke of Hiſtories, yet I beléeue that no Roman came euer there to deſcribe the Promontorie. Neither doe I beléeue that the Frier of Oxford, by vertue of his Art of magike, euer came ſo nigh the Pole to meaſure with his Aſtrolabe thoſe cold parts, together with the foure flouds, which Mercater and Barnardus doe deſcribe both in the front, and alſo in the nether end of their Maps, vnleſſe he had ſome cold Deuill out of the middle Region of the aire to be his guide. And therefore I take them in mine opinion to be méere fables. Truly, if any men ſhould diſcouer thoſe parts me thinketh that the people of Finmarke, and of Wardhouſe, or ſuch like people, bordering vpon the North Seas, ſhould beſt do it, hauing bodies vſed to extreme cold. But then being bred in ſo groſſe an aire, their wits perhaps are too groſſe for ſuch a purpoſe.

The Frier of Oxford.

I remember that William Bourne in his booke called the Regiment of the Sea, ſetteth downe fiue ſundry waies to ſaile into Cathay, whereof the firſt way is by the Cape of good Hope, in the outermoſt South part of Afrike: The ſecond by the Sea called Mare Magellanicum: The third way is to ſaile betwixt yͤ North part of America, and the Iles of Groynland and Crockland: The fourth is by Noua Zemla, whereas Sir Hugh Willoughby, in ſéeking that way was frozen to death: The fift way is to ſaile right vnder the Pole, that is, firſt from South to North, vntill you be right vnder the Pole, and then from North to South, alleaging there certaine reaſons to proue the thrée laſt waies, poſſible to be as paſſable as the firſt two wayes, well knowne in theſe daies, and vſually haunted.

The ſtrongeſt reaſon that Bourne vſeth to make the foreſayd Seas Nauigable, is, for that the Sunne by his long tarrying aboue the Horizon, ſo warmeth both land and Sea, as it cannot be euer ſone cold againe. But I pray you what heat can the Sun yéeld

yéeld to that place aboue whoſe Horizon he is neuer eleuated more then 23. degrées and a halfe, a very cold winterly heate God wot. And though the cold were not ſo extreame as I take it to be indéed, yet in deſert places, where is there any ſafe harbour, freſh water, or any neceſſary ſuccour to be had: For in taking ſuch a iourney, let no man thinke to goe through without a bait, vnleſſe he ſaile in Pegaſus, and hath both wind & tide at will.

Notwithſtanding, I can greatly commend thoſe valiant minds, that doe attempt ſuch deſperate voyages, and the rather when they doe it for knowledge ſake, and to profit their country, and not altogether for priuate gaine and lucre.

But truly for mine owne part, I thinke it vnpoſſible that any man bred in any of the temperate Zones, for in the hot Zone, is euer able to cõtinue ẏ whole iourney in any of thoſe thrée waies: no, though they were much more paſſable then I take them to be indéed. But if they were paſſable in all reſpects, ſauing for cold, then I thinke no nation or people ſo méete to attempt thoſe waies, as thoſe which I haue already named, or ſuch like, borne and bred nigh vnto the North Seas. But leauing theſe matters, let vs now ſhew how euery one of the foure foreſaid parts of the earth, that is, Europe, Afrike, Aſia, and America, is bounded, and how many miles each part containeth as well in longitude as in latitude, according to ſuch longitude and latitude, as Mercator and Puteanus doe ſet downe in their Maps.

Europe is bounded on the North with the North Ocean ſea, & on the South with ẏ Sea called Mare Mediterraneũ, on the Eaſt with the floud Tanais, & on the Weſt with the Weſt Ocean ſea. Europe in meaſuring with a right line from the furtheſt part of Ireland on the Weſt, vnto the floud Tanais on ẏ Eaſt, both places hauing 52. degrées of latitude, hath in longitude 2166. miles, and in meaſuring with a right line from ẏ furtheſt part of Morea, on the South, whoſe latitude is 35. degrées vnto the North ſea ſide, hauing 72. degrées of latitude, hath in lõgitude 2220. miles. Afrik is bounded on the North with the ſtraight ſea Gibralter, & with the Sea called Mare Mediterraneum, & on the South with a Sea which diuideth Afrike frõ the South land, not yet fully knowne, and on the Eaſt with the red ſea, or gulfe of Arabia, and on the

Weſt

Weſt with the great Ocean Atlantique. Afrike in meaning with a right line from Gambra on the Weſt vnto the Cape de Gardaſa on the Eaſt, both places hauing ten degr. of North latitude, or thereabout, hath in longitude 4425. miles. And meaſuring with a right line from the fiftieth degrée of the Equinoctiall vnto the Sea, called Mare Mediterraneum, it hath in North latitude thirty two degrées, which being multiplied by ſixty, maketh 1920. miles. In South latitude meaſuring with a right line, from the fiftieth degrée of the Equinoctiall vnto the Cape of good hope, called in Italian Capo di buona ſperanza, and in Latine Caput bonæ ſpei, it hath thirty fiue degrées, which being multiplied by ſixtie, maketh 2100. miles, which maketh the whole latitude of Africa to be 4020. miles.

Aſia is bounded on the North with the North Ocean Sea, & on the South partly with ẏ red ſea, which ſea according to Pomponius Mela, extendeth to the Iſle ſometime called Taprobana, now Sumatra, which is a famous market-place of all manner of ſpices: alſo Aſia is bounded on the South with diuers other Gulphes and Seas, as you may ſée in the Map: Againe, on the Eaſt it is bounded with the Eaſt Indian Ocean, and with the ſtrait Sea of Anian, and on the Weſt, it hath the floud Tanais, and the Fenne of Meotis, and diuers Seas, as Boſphorus Cimmerius, the Sea called Mare Euxinum, the Sea Boſphorus Thracius and Propontis, & part of the Sea Mediterraneum, & part of the red Sea or gulfe of Arabia, which diuideth Afrike from Arabia Felix. Aſia in meaſuring with a right line, from the mouth of the floud Tanais to the promontorie Tamos; both places hauing fifty degrees of latitude, hath in longitude 4284. miles, & in meaſuring with a right line from the 150. degrée of the Equinoctiall vnto the promontorie Tabin, Aſia hath in North latitude ſeuenty fiue degr. which being multiplied by ſixty, maketh 4500. miles.

America is bounded on the North, with the North Ocean ſea, and on the South, with the ſea called Mare Magellanicum, on the Eaſt with the great Ocean Atlantique, & on the Weſt with the Weſt Indian Ocean, and the ſtrait ſea of Anian. America in meaſuring with a right line from the ſtrait of Anian to the furtheſt part of Eſtotiland vpon the 64. degrée of latitude, hath in longi-

tude

tude 164. degrées, which maketh 3264. miles, and in meaſuring with a right line from the 270. degrée of the Equinoctiall vnto the North Sea, it hath in North latitude 76. degrées, which maketh 4560. miles, and yet the quantity of the ground deſcribed in the Map, is not ſo great as the other by a ſeuenth part: wherin I can very well excuſe the Map-makers, not hauing perhaps as yet the true longitude of that part of America.

Finally, in meaſuring with a right line from the 305. degrée of the Equinoctiall vnto the Sea called Mare Magellanicum, it hath in South latitude fiftie thrée degrées, thirtie, which maketh 3210. miles.

How to find out the Longitude and Latitude of any place contayned in the Map.

Now if you would know what Kingdomes, Regions, Cities, Mountains, Floods, Lakes, alſo what Seas together with their Ilands, Ports, Capes, Points & Bayes do belong to euery one of the foreſaid foure parts, then ſtudie wel theſe modern Maps; & with your eye you ſhall behold, not onely the whole world at one view, but alſo euery particular place contayned therein. Which to deſcribe at ẏ ful in writing, wold require a long time, wherfore leauing ẏ to your own induſtry, I will ſhew you how to find out the longitude and latitude of any place in the Map.

Alſo to know how one place lyeth from another, and with what wind you haue to ſayle from one place to another. And finally, how to find out the true diſtance betwixt place and place, in which things the chiefe vſe of Maps doth conſiſt.

And firſt you haue to vnderſtand, that the Meridians which you ſée in the Map, do ſerue for diuers purpoſes. For you learne thereby that it is noon-tyde or mid-day, ſooner to one place then to another, by marking what Meridian is more towards the Eaſt, which the Sunne alwayes toucheth ſooner then that Meridian which is more towards the Weſt. Alſo by the Meridians you know how the Eclipſe of the Moone appeareth ſooner to one place then to another, and with what varietie of time.

For they whoſe Meridian is toward the Weſt, do ſée the Eclipſe of the Moone ſooner then they whoſe Meridian is more towards the Eaſt, wheras in very truth the Eclipſe of ẏ Moone is ſéene to all places (where it can be ſéene) at one very inſtant of like greatnes, & yet ſéemeth to be ſeene later or ſooner, by reaſon

of

of the diuerſity of the time of the day, in places ſtanding on Eaſt or Weſt from another. And if the diſtance betwixt thoſe 2. Meridians doe contayne 15. degrees of the Equinoctiall, then the Eclipſe appeareth to be ſooner to the one, then to yͤ other by one whole houre. For euery 15. degrees maketh an houre, and therfore looke how many 15. degrees you finde betwixt the two Meridians, ſo many houres are to bee accounted. And if you finde fewer degrees, then the time of the Eclipſe is to be ſhortened accordingly, and by attributing foure minutes of an houre to one degree, (for foure times 15. maketh 60. minutes, which is alſo one houre) you may make your account ſo ſmal or great as you will. And note alſo that you may conceiue to bee in the Map, as many Meridians as there are degrees in the Equinoctiall.

As for the Eclipſe of the Sunne, it is ſeene neither generally, nor fully at one ſelfe-ſame time, nor yet of the ſame greatnes in all places. Indeed, it appeareth ſooner to the Weſterne Countries, then to the Eaſterne. But the diuerſity of the time of appearance, doth depend not onely of the number of Meridians, betwixt the two places, but alſo of the ſwift or ſlow motion of yͤ Moone, which comming betwixt vs and the Sunne, taketh the ſight of the Sunne from vs.

Moreouer, by the Meridians you ſhall know what longitude any place in the Map hath by doing thus. Firſt, ſet the one foot of your compaſſe in the place it ſelfe, and the other in ſome Meridian that is next vnto it, whether it be on the left or right hand, it maketh no matter: and from thence draw downe your Compaſſe, following ſtill that Meridian vntil you come to the Equinoctiall Line, and there marke vpon what degree of the Equinoctiall that foot of your Compaſſe which you did firſt put in the place, doth reſt, and there make a pricke. That done, count how many degrees that is diſtant from the firſt Meridian, and that is the true longitude of the place: and that longitude ſerueth to all the places that be vnder that Meridian, though they be neuer ſo farre diſtant one from another, North and South.

Now if you would know, the latitude of any place in the Map, that is to ſay, how far it is diſtant from the Equinoctiall, either Northward or Southward, either of which Latitudes contayneth

neth 90. degrees, then doe thus: ſet the one foot of your compaſſe vpon the very place, and the other vpon that Parallel which is next it, whither the parallel be aboue it or beneath, it maketh no matter, and draw your compaſſe from that place, following ſtill that Parallel, vntil you come to the Meridian, which is marked with the degrees of latitude, which Meridian in the latter Maps, ſtandeth ſomewhat more Weſt then the firſt Meridian doth. And marke vpon what degree that foote of your compaſſe, which you did draw from the place doth reſt, and there make a pricke, that done, count how many degrees that pricke is diſtant from the Equinoctiall, and that is the true Latitude of that place. And the like latitude haue all they that dwell vnder that Parallel, how farre ſoeuer they dwell a ſunder, Eaſt and Weſt. And by knowing the Latitude of any place, you may quickly finde alſo in ſome Maps, vnder what clime or Parallel ſuch place is ſituated, and of how many houres the longeſt day is there, as in the Map of Vopellius, of Gemma Frizius, and diuers others. But in theſe latter Maps ſuch things are not ſet forth, wherefore not hauing the other Maps, you may reſort to the tables ſet downe in my Spheare, which doe ſhew all ſuch things at the full.

Now to know how one place beareth from another, and with what wind a ſhip is to be directed from one port vnto another, & alſo what diſtãce is betwixt two places, that is, how many miles one place is diſtant from another, the latter Coſmographers, as Mercato, Barnardus, Puteanus, & diuers others, haue inuented a new inſtrument called Organum directoriũ, which they ſet down in their maps, together with the vſe thereof. But in mine opinion not plainely enough for moſt mens capacitie. This inſtrument containeth two Quadrants of a Circle, hauing the names of the winds written therein: And they call the vpper Quadrant Organum Superius, and the nether Quadrant Organum Inferius. Which two Quadrants haue two lines marked with degrees, & are ioyned together with a right angle, of which two lines, the ſtanding or hanging line on the left hand, doth ſignifie yͤ firſt Meridian, and is marked with 75. vnequall degrees of latitude, in ſuch proportion as the middle Meridian of the map hath. The other line which lieth ouerthwart, ſignifieth the Equinoctiall, & is

Organum directorium, with the deſcription and vſe thereof.

is marked with ninety equall degrées of longitude. But the ſpaces of the parallels of latitude, are in number ſeuen and a halfe, euery whole ſpace containing ten degrées: and the halfe ſpace but fiue degrées, which ſpaces are wider and wider towards the Pole, and of like proportion to thoſe of the Map.

And note by the way that the higheſt right line that goeth from the firſt Meridian towards your right hand, is the Eaſt line, and the nethermoſt line ſignifying the Equinoctiall is the Weſt line. For the vpper Quadrant commeth towards you from Eaſt to South, & the nether Quadrant goeth from you towards the left hand from Weſt to South, and in the Center of each Quadrant, muſt bee put a long thréed to ſhew the direction from place to place. The vſe of this Inſtrument is thus: firſt hauing found out in the Map the ſeuerall Longitudes & Latitudes of two places, in ſuch order as is before taught, ſéeke yͤ latitude of the firſt place in the firſt Meridian, & there make a marke. I call here the firſt place, that from whence you go, and the ſecond that to which you goe. That done, ſéeke out in the ſaid Meridian, the latitude of the ſecond place, & there make another marke. And from that marke of the ſecond place draw a right line towards your right hand, ſo as it may be a parallel to yͤ Equinoctiall line. Then take the difference of the two longitudes, by ſubtracting the leſſer out of the greater, and ſéeke out the degrées of that difference in the Equinoctiall line, & there make a marke; from which marke draw a right line that may be a parallel to yͤ firſt Meridian. And whereas this line croſſeth the firſt line, there ſet downe a marke; then draw a right line from the marke of the firſt place, ſo as it may paſſe thorow the croſſing point. That done, if the latitude of the firſt place be greater then yͭ of the ſecond place, make a parallel to that line with the thréed of the vpper Quadrant, but if the latitude of yͤ firſt be leſſer then the ſecond, thē make a parallel vnto the ſaid line with the thréed of the nether Quadrant, which with the helpe of your compaſſe you ſhal eaſily do. And that thréed being ſtretched out amongſt the winds, will ſhew by what wind the ſecond place beareth from the firſt. And the oppoſite wind is the director, whereby you haue to ſaile. Yet neither Mercator, nor Barnardus doe plainly ſhew how to find out the true diſtance of two places by this Inſtrument, nor yet doe ſet downe in their Maps, eyther ſkale or trunke, to take the diſtance betwixt two places with the Compaſſe, as moſt commonly all other Maps & Mariners Cards haue, but do refer the plaine declaration thereof to other Bookes and Tables, which I haue not yet ſéene: and therefore in the meane time I thought good to ſet downe according to Barnards rule, this brief way of finding out the diſtance of any two places whatſoeuer is ſet down in their Maps. Firſt, with your compaſſe, take the iuſt diſtance of the two latitudes vpon the firſt Meridian, which is otherwiſe called the difference of the latitude. And hauing laid a Ruler or thréed to the places, looke how many times the foreſaid diſtance, or difference taken with your Compaſſe, is comprehended in the ſpace that lyeth betwixt the two places, and by ſo many times multiply the ſayd difference; the product whereof being multiplyed againe by fifty, will ſhew how many miles the one place is diſtant from the other. As for example, the diſtance or difference betwixt the two latitudes of London and Hieruſalem, is ninetéene degrées or thereabouts, which being taken with your Compaſſe, you finde to be two times contayned in the ſpace betwixt Hieruſalem and London. Wherefore in multiplying ninetéene degrees by two, you find the product to be thirtie eight, which being multiplyed by fiftie, maketh 1280. miles, and ſo farre is Hieruſalem from London by a right line. But if in meaſuring yͤ diſtance betwixt two places with your cōpaſſe, there remayn any odde ſpace not fully anſwering the firſt wideneſſe of your compaſſe, then take that odde ſpace with your Compaſſe being ſtraightened and made fit thereunto, and looke how many degrees the ſaid odde ſpace comprehendeth in the firſt Meridian, about the midſt of the degrees of the foreſaid difference of latitude, & adde thoſe degrees alſo to the reſt which you haue alreadie meaſured and multiplyed, and by multiplying the whole ſumme by fiftie, you ſhall haue the diſtance.

Againe, it may be that the two places doe not differ at all in Latitude but only in Longitude. For as I haue ſaid in my Spheare, two places may differ thrée manner of wayes, that is in latitude only, in longitude only, or in both. And there I doe ſhew how euery one is to be meaſured.

But

But becauſe that order of meaſuring is ſomewhat buſie, to ſuch as are not very well exerciſed in Arithmeticke, & doe not know the vſe of that Table of Signes called in Latine Tabulæ ſinuum, I thought góod to ſet downe here a more eaſie way of meaſuring, though perhaps not altogether ſo iuſtly, & yet without any great errour. Wherefore, if the two places doe differ both in longitude and latitude, then you muſt doe as before is taught: But if they differ onely in latitude, then you haue no more to doe, but to multiply the difference of the two latitudes by ſixtie miles, and if there be any odde minutes, then to allow for euery minute one mile. As for example, Compoſtella & Liſbone, two Townes, the one in Spaine, the other in Portugale, haue one ſelfe-ſame longitude differing only in latitude, which difference is foure degrées and twenty minutes.

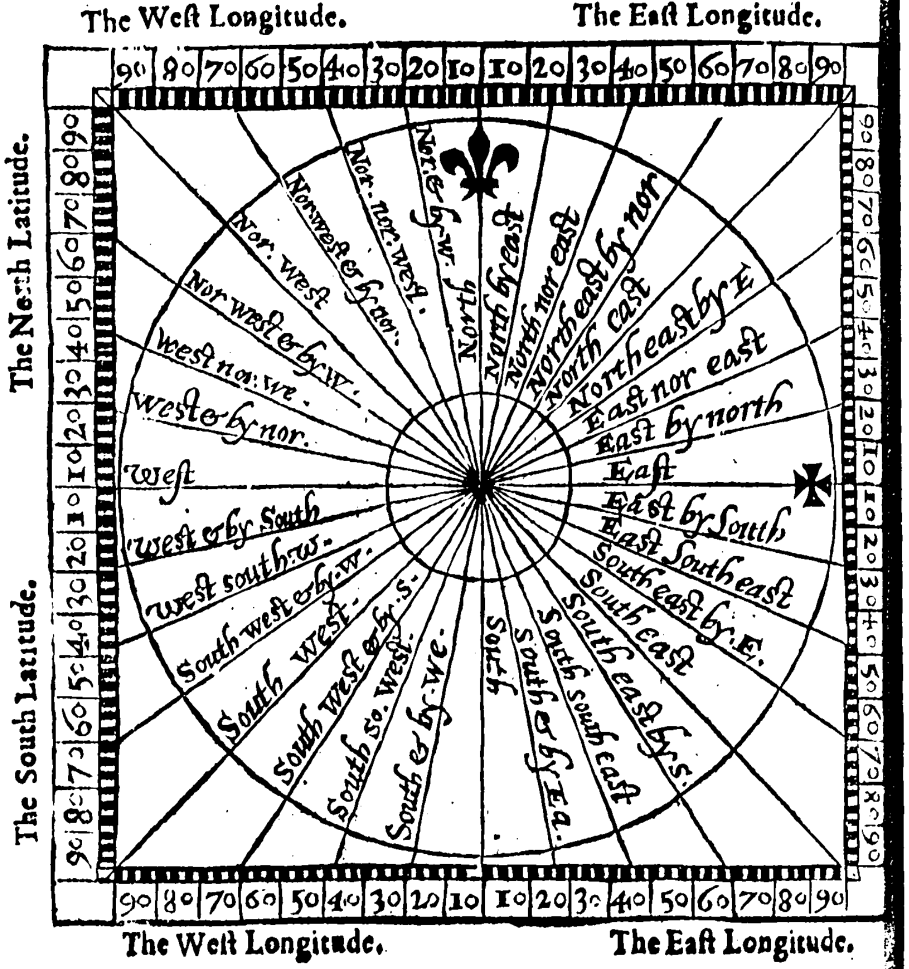
Here if you multiply foure by ſixty, it amounteth to 240. miles, whereunto by adding twenty miles for the twenty minutes, you ſhall find the whole ſumme to be 260. miles, which is the diſtance by a right line betwixt Compoſtella & Lisbone.

But if the two places hauing one ſelfe-latitude, do differ only in longitude, then looke how many ſuch degrées as are of equall quanty, to the laſt degrée of the ſame latitude, are contayned betwixt the two places by a right line, and by allowing for euery degrée ſixty miles, you ſhall haue the true diſtance, or at the leaſt not much differing from the truth. And if you ſée that the two places in yͤ Map do ſtand far a ſunder, then for yͤ more ſpéedines, take with your Compaſſe fiue ſuch degrées at once, being firſt pricked vpon a péece of paper, which is iuſt 300. miles, and at that wideneſſe meaſure the ſaid ſpace, and if there remayn at the leaſt any odde ſpace, then ſtraighten your Compaſſe, & ſit them to that odde ſpace, and looke how many of the foreſaid degrées that comprehendeth, and hauing multiplyed the ſame by ſixty, adde the product thereof to the former ſumme.

As for example, Compoſtella and Conſtantinople, hauing one ſelfe-ſame latitude, that is, fortie thrée degrées of North latitude do differ only in longitude: Here with my Compaſſe I prick vpon a péece of paper, fiue degrées like in quantity to the laſt, & the vppermoſt degrée of the foreſaid forty thrée degrées, & meaſuring with the wideneſſe of my Compaſſe the ſpace betwixt the two places, by a ruler or right line I find that ſpace to comprehend the foreſaid wideneſſe of my Compaſſe 6. times, which maketh 1800. miles, and that there remaineth an odde ſpace containing 3. of the foreſaid degrées, that is, 180. miles, which being added to the former ſumme, maketh in all 1980. miles, which is the diſtance betwixt Compoſtella & Conſtantinople. Alſo if you would know the diſtance betwixt two Townes in Africk, the one called Bubonell, ſtanding vpon Capo viride, and the other called Ercoco, ſtanding hard by the red Sea, both places hauing one ſelfe ſame latitude, that is to ſay, 14. degrées of North latitude, or thereabouts, and doe differ onely in longitude: Then pricke with your Compaſſe vpon a péece of paper 5. degrées, euery one equall to the laſt degrée of the foreſaid latitude. And in meaſuring the ſpace betwixt thoſe two places with that wideneſſe of your compaſſe, you ſhall find the ſame to be comprehended in the ſaid ſpace 12. times, which by allowing 300. miles to euery wideneſſe, amounteth to 3600. miles, and the ouerplus of the odde ſpace being two degrées, is 120. miles, which being added to the former ſumme, maketh in all 3720. miles, and that is the diſtance betwixt Bubonell and Ercoco.

And if this way like you not, then multiply the difference of the two longitudes, by yͤ miles anſwerable to a degrée of longitude in the latitude of the ſayd places, which you ſhall find in a ſpeciall Table, made for that purpoſe, and is ſet downe in my Spheare, together with the rule and order that is to be obſerued therein. The hardeſt of which two waies, in mine opinion, is much more eaſie than that which is to be done by the former Inſtrument, called Organum directorium. Which Inſtrument Mercator and Barnardus did borrow, as it ſéemeth to me, from that which Gemma Friſius calleth his Quadratum Nauticum, inuented by him many yeeres ſince: the ſhape, deſcription, and vſe whereof, I thought it not a miſſe to ſet downe here, and the rather for that, in mine opinion, it ſheweth both the true courſe and direction to any place more ſpéedily, and with more facilitie then the other.

Herefolloweth the Mariners Quadrant.



A Deſcription of GEMMA FRISIVS *his Inſtrument, called* Quadratum Nauticum.

This Square, by two right Lines, called Diameters, croſſing one another with right Angles in the very Centre, is diuided into foure equall quarters, and within the ſaid Square, vpon the ſaid Centre, is drawne a Circle, which by meanes of the two foreſaid Diameters, is alſo diuided into foure Quadrants, & euery Quadrant is ſubdiuided with right lines into eight parts, ſo as in all, there be two and thirty lines, ſignifying the two and thirty Winds of the Mariners Compaſſe, euery Line hauing his proper name of Wind written thereon. And note, that the right Line, which is drawne right downe in the middeſt of the Square, ſignifieth the Meridian, ſhewing the North point aboue, and the South point beneath, and the other right line, croſſing the ſame in the Centre, ſignifieth the Equinoctiall line, which ſheweth the Eaſt point on the right hand, and the Weſt point on the left hand, and the Circle it ſelfe ſignifieth the Horizon.

Now you haue to vnderſtand, that from the Equinoctial line vpwards, the two ſides of the Square are diuided each of them into 90. degrées of North latitude, & the other two ſides from the Equinoctiall downeward, are likewiſe diuided on both hands into 90. degrées of South latitude. Then the head or front, & alſo the baſe of the ſaid Square is diuided in the midſt by the foreſaid Meridian line into two equal parts, whereof the firſt procéeding from the ſaid Meridian towards the right hand, is diuided as well aboue as beneath into 90. degrées of longitude, and that is called the Eaſt longitude, and the other part procéeding from the ſaid Meridian towards the left hand, is likewiſe diuided as well aboue as beneath into 90. degrées of longitude, and is called the Weſt longitude. The vſe of which Inſtrument is thus: Firſt, knowing by ſome Table or Map, the longitude and latitude of two places, take the difference of both by ſubtracting the leſſer out of the greater. And if the longitude of the ſecond place bee greater then the firſt, ſéeke the difference thereof in the front, and alſo in the baſe of the Eaſt longitude on the right hand. But if the longitude of the ſecond place be leſſe then the firſt, then ſéeke the difference thereof in the Weſt longitude on the left hand. And here, as before, I meane by the firſt place that from whence you goe, of which two places, the firſt is alwaies ſuppoſed to bée in the very Centre of the Circle, and the other is to be found out thus: firſt, hauing ſought out the degrées of the difference of the longitude, as well in the vpper part, as in the nether part, and marked the ſame with one pricke aboue, & another beneath, apply your Ruler or a thréed to theſe two pricks, or elſe draw a ſecret right line from the one pricke to the other, by a ruler. That done, ſéeke out the difference of the two latitudes on both ſides of the ſquare, that is to ſay, if the ſecond place hath greater latitude then the firſt, then you muſt ſéeke the difference in ye North latitude, if leſſe, then ſéeke that in the South latitude. And hauing marked the ſame on both hands, by ſetting downe on each ſide a pricke, draw a ſecret right line from marke to marke, and where the laſt line croſſeth the firſt line, there make a marke, for there ſtandeth the place whereto you would goe. Which if you would know how it beareth from the firſt place, then lay your ruler both to the Centre, & alſo to that marke, drawing a right line paſſing through the Centre, and alſo through the ſaid marke from the one ſide of the Circle to the other, or elſe ſtretch a thréed through the Centre & the marke, and on that ſide that the marke is, you ſhall ſée the name of the winde that ſheweth how the ſecond place beareth from you, the oppoſite point whereof is the winde, whereby you haue to ſaile. As for example, if you would know how Venice beareth from London.

Now, if you ſéeke in the Map, you ſhall find London to haue in longitude 23. degrées and 0. minutes, and in latitude 51. degrées, and 32. minutes. Againe, you ſhall find Venice to haue in longitude 36. degrées, and 30. minutes, and in latitude 45. degrées, and 15. minutes, or thereabouts.

The difference of the longitude is 13. degrées, & 30. minutes, which becauſe the longitude of Venice is greater then the longitude of London, you muſt ſéeke it out in the Eaſt longitude on the right hand, and marke the ſame both aboue and beneath. Againe, the difference of latitude is 6. degrées, and 17. minutes. Which becauſe Venice hath the leſſer latitude, ſéeke that out in the South Latitude, marking the ſame on both hands. That done, lay two thréeds, or elſe draw two right croſſe lines from the foreſaid markes, and where thoſe two thréeds or lines doe croſſe, make a marke, which marke ſignifieth the place whereunto you would goe, which is Venice.

Then from the one ſide of the Circle to the other, lay a Ruler, or thréed, paſſing through the Centre, and the ſaid marke made for Venice, at the end of which thréed, ruler, or line, on the right hand, you ſhall ſée the wind which ſheweth how Venice beareth from London, and on the left hand the wind whereby you haue to ſaile, if the ſpace betwixt the two places were all Sea. For in ſailing by Sea, you may not think to go alwaies by a right line, but often to change your courſe according as either mainland, headlands, Iles, currents, ſands, rockes, or ſuch like impediments, ſhall giue occaſion: and therfore though your right courſe from London to Venice, is to goe South-eaſt & by Eaſt, yet being come out of the Thames to Douer, your courſe from thence to the Cape of Britaine is Weſt South-weſt. And from thence to the Cape Finis terræ in Spaine, it is South-weſt and by South. And from thence to the Cape S. Vincent in Portugall, you goe right South: and from thence to Gibralter almoſt Eaſt South-eaſt. Againe, from Gibralter to the South point of Sardinia, your courſe is almoſt Eaſt and by North. And from thence to the South point of Sicilia, almoſt Eaſt South-eaſt: and from thence to Corfu, your courſe is iuſt North eaſt, and from thence to Venice, you turne againe North-weſt.

Thus you ſée that in going by Sea, one courſe doth not hold, no nor yet in going by Land, ſith mountaines, riuers, and lakes, may put you out of your right courſe, and yet it is neceſſary to know how the place, whereunto you goe, beareth from you, to the intent that being out of your way, you may alwaies the better direct your courſe right againe to the ſame.

Moreouer, Gemma Friſius ſaith, that by this inſtrument you may alſo find out the difference of Longitude betwixt the two places from whence and whither you goe, ſo as you know before how the ſecond place beareth from the firſt, and alſo the difference of their latitudes. As for the latitude of each place, you may eaſily find the ſame with your Aſtrolabe Quadrant, or croſſe-ſtaffe, by taking therewith the Meridian altitude of the Sunne, or the higheſt altitude of ſome ſtarre that you know: The order whereof, I haue ſet downe in my Spheare. And the coaſt of the Countrie and place whereunto the ſhip is to be directed, is commonly well knowne to the Mariners how it beareth from the firſt, and ſpecially hauing a proſperous winde.

Then knowing theſe two things, you muſt doe thus: Firſt, hauing drawne a ſecret line or thréed, from the difference of the two latitudes, placed according to the rule of greater and leſſer, before ſet downe, and marked on both ſides of the Inſtrument: draw another thréed, or elſe lay a ruler ſo as it may paſſe through the Centre, and the line of the winde, or coaſt, whereby the ſecond place beareth from the firſt. And whereas thoſe two lines or thréeds doe touch, make a marke, and then lay a Ruler, or extend a thréed from the vpper line to the nether line of longitude, ſo as it may paſſe hard by the laſt marke, and then the Thréed or Ruler ſo laid, will ſhew you the difference of longitude betwixt the two places. And by this meanes Gemma Friſius ſaith, that the Mariners may eaſily correct the longitude of places as they ſaile: but how truly, I referre that to the ſkilfull pilots.

But for mine owne part, hauing to ſéeke out, in theſe latter maps, the way by Sea or Land to any place, I would vſe none other Inſtrument of direction then halfe a Circle, diuided with lines like a mariners Flie, in ſuch ſort as you ſée in this figure.

The ſhape of the Flie, the vſe whereof followeth.

THis Flie containeth two quarters of the Mariners Compaſſe, the middle line whereof marked with a Croſſe, ſignifieth the line which runneth Eaſt and Weſt. For if the place whereto you goe, be on your right hand, then the Croſſe ſignifieth the Eaſt point, but if it bée on your left hand, then turning the Flie towards your left hand, the Croſſe doth ſignifie the Weſt point, and the right downe line, croſſing the foreſaid middle line with right Angles in the very Centre, is the Meridian line, ſhewing the North and South, according as you turne the Croſſe, Eaſt or Weſt.

The vſe of which Flie, is thus: Firſt, with a pin or a néedle being thruſt through the Centre of the Flie, prick the pin downe in the very place from whence you goe, called before the firſt place, and if the ſecond place be on your right hand, then turne the Croſſe of your Flie that way, but ſo as the Meridian of the

Flie, may be a true Parallel to the next Meridian of the Map, that is on your left hand, which your Compaſſe will quickly performe, by taking therewith a iuſt ſpace at both ends of the Flie, betwixt the two foreſaid Meridians, that is to ſay, the Meridian of the Flie, and the next Meridian of the Carde or Mappe.

That done, extend your threed ſo as it may paſſe through both the Centre of the Flie, hard by the pinne, and alſo through the ſecond place, and then looke vpon what wind or coaſt of the Flie the threed lieth, and that wind ſheweth how the ſecond place beareth from you. And the oppoſite winde thereof ſheweth by what wind you haue to ſaile thither.

But if the ſecond place bee on your left hand, then you muſt turne the croſſe of the Flie towards your left hand, and hauing ſet downe the Centre of the Flie in the firſt place, and with your Compaſſe made the Meridian of the Flie a iuſt Parallel, to the next Meridian of the Map that is on your right hand, lay your threed to the two places as before, and marke vpon what winde of the Flie it ſtriketh, and you ſhall haue your deſire. The leſſer that your Flie be, the better, for being great it would couer too many places of the carde or mappe. But if the two places ſtand ſo nigh together, as the Flie doth couer them both, then hauing ſet downe your pinne in the firſt place, make your threed with a nooſe, and hauing put the ſame ouer the pinne, draw the threed through the ſecond place, ſomewhat beyond the Compaſſe of the Flie, and hold it there faſt vntill you haue alſo put the Centre of the Flie ouer the ſaid pinne or needle, and duely placed the ſame in ſuch forme as it is before taught, and in ſo doing, that line of the Flie, which lyeth vpon the threed, will ſhew your courſe and direction aſwell as if the threed lay aboue the Flie.

Truly, I doe thinke, the vſe of this Flie a more eaſie and ſpeedie way of direction, then the manifold tracing of the mappes or Mariners cardes, with ſuch a number of croſſe lines, as commonly are drawne therin, cauſing rather a confuſion then otherwiſe: for in ſuch Cardes as are made with right Meridians, you ſhall find the Flie to be much more ſeruiceable then theſe manifold lines.

The

The vſe of Ptolomies *Tables.*

THus much touching the vſe of Maps, and Cardes. Now, according to my promiſe, I will briefly ſhew you the vſe of Ptolomies Tables, or of any other Table made in that forme. The chiefeſt point whereof is readily to find out any place that you ſeeke, and to know where it ſtandeth: For the accompliſhment whereof, you muſt firſt know what longitude and latitude that place hath.

The Longitudes and Latitudes of all places, deſcribed by Ptolomie, are ſet downe in his ſecond, third, fourth, fift, ſixt, and ſeuenth Booke of Geographie. For, in his ſecond Booke he deſcribeth the Weſt part of Europe, containing Ireland, England, and Scotland, Hiſpania, Gallia, Germanie, Hungarie, & Slauonie. In his third Booke he deſcribeth the Eaſt part of Europe, as Italie, Sicilia, Corſica, Sardinia, Sarmatia, Taurica, Peninſula, Datia, Miſia, Thracia, Macedonia, Achaia, Peloponneſus, Candia, Rubia, and diuers other Lands and Iſlands. And he containeth all Europe in ten Tables. In his fourth booke hee deſcribeth Afrike, that is to ſay, ſo much as was knowne in his time, containing the ſame foure Tables. In his fift, ſixt, and ſeuenth Booke, hee deſcribeth all Aſia, and the Eaſt Indies, whereof he maketh 12. Tables, and in deſcribing any Region or Prouince, he ſheweth how it is bounded both North and South, Eaſt and Weſt. And alſo what notable Cities, Floods, Lakes, or Mountaines, be in euery Region, and therewith ſetteth downe the longitude and latitude of euery place: to which his Booke, diuers haue made certaine Alphabeticall Tables, containing the names of all the places that are mentioned in the foreſaid bookes, ſhewing in what leafe to find the ſame: to the intent that you may the more readily find out, not onely the place, but alſo the longitude and latitude thereof, and in what Table it is contained.

Notwithſtanding, I know by good triall, that there are a number of places mentioned in the ſaid bookes, which you ſhall not find in the foreſaid Alphabet.

Wherefore I wiſh, that Mercator, Ortellius, Barnardus, Brugenſis, or any other of the Coſmographers, and ſetters forth

of

of Maps and Cardes, would take the paines to make a generall Alphabet, containing all the names that are to bée found and knowne, both ancient and moderne, of Regions, Cities, Seas, Flouds, Lakes, Riuers, Ports, Bayes, Headlands, Capes, Mountaines, and all other notorious places, contained in their Maps and Cards, together with the true longitude & latitude, annexed to euery place, and agréeable to their Maps, to the intent, that euery man delighted with the reading of Hiſtories, may in their Maps, both generall and ſpeciall, eaſily find out any place that he ſéeketh. Which worke, in mine opinion, would be moſt thankefully receiued of all thoſe that delight in Geographie, to the great commendation and praiſe of the Authors thereof.

For though Ptolomie, Appian, Gemma Friſius, Gaſtaldus, Orontius, Munſterus, Ortelius, & others, haue ſet downe certaine names, both Ancient and moderne, together with their Longitudes and Latitudes, yet they are but very few in compariſon of all the names that are wanting, yea or of thoſe that are comprehended in their owne Cards & Maps, all which Maps I would wiſh to agrée in their longitudes and latitudes: for otherwiſe a man ſhall hardly find the place which he ſéeketh.

Wherefore I pray God with all my heart, that ſome good man that is a ſkilfull Coſmographer may ſhortly trauell herein, vnto the profit of all Students in Geographie.

But now to returne to my matter, which is to ſhew how to find out any place contained in Ptolomies Tables, I ſay that you muſt firſt find out the name of the place in the Alphabet, and that will direct you to the booke wherein it is ſet downe, together with the longitude and latitude thereof. And there alſo you ſhall find in what Table it is contained.

Then hauing taken a note of the longitude and latitude, and alſo the number of the Table wherein it is to bée ſought, reſort to that Table, be it in Europe, Affrike, or Aſia. In the front of euery which Table, and alſo in the baſe are ſet downe certaine numbers of longitudes, in ſuch ſort as the vppermoſt & nethermoſt be like numbers, and doe directly anſwer one another. Againe, on both ſides of the Table are ſet downe certaine numbers

of Latitude like in quantity, and directly anſwering one another.

Then ſéeke out the Longitude of the place which you would find in the front, and alſo in the baſe, and marke the ſame with two prickes, one aboue and another beneath: From which two prickes, lay a Ruler, or extend a thread, holding it faſt there vntill you haue found out the latitude of the place on both ſides of the Table, which being alſo marked on each ſide with a pricke, extend another thread from thoſe two laſt pricks, and in that very point whereas the 2. threads do croſſe, you ſhal find the place for which you ſéeke, or at leaſt ſhould be there. Moreouer, on the right hand of euery Table, Ptolomie ſetteth downe moſt commonly, vnder what Clime and Parallel euery place is, and by that meanes you may alſo know the longeſt day that any Parallel hath. For as I haue ſaid before in my Spheare, euerie Parallel procéeding from the Equinoctiall towards the Pole, encreaſeth by one quarter of an houre, and euery Clime containing two Parallels increaſeth by halfe an houre.

Of which Climes Ptolomie ſetteth downe but ſeuen, but of Parallels he maketh 21. in ſuch order as this Table following ſheweth, which Table conſiſteth of foure Columnes, whereof the firſt contayneth the 7. Climes, together with their names, and alſo how many miles euerie Clime hath in breadth. And the ſecond contayneth 63. degrées of latitude, further than which Northward, Ptolomie his Tables doe not extend. The third contayneth the numbers of the 21. Parallels: and the fourth, the houres and minutes of the longeſt day in euery Parallel, as this Table here next following ſheweth.

The

	The ſeuen Climes with their names and Miles in breadth which you muſt count from beneath vpward.	The degrees of Latitude	The twenty one Parallels.	The houres & minutes of the longeſt day in euery Parallel. H.	M.
			21	19	30
		63	20	19	0
			19	18	30
		60	18	18	0
			17	17	30
7	Dia Ripheos.	50	16	17	0
	195		15	16	30
6	Dia Boriſtines.		14	16	0
	225.		13	15	30
			12	15	0
5	Dia Romes.		11	14	45
	270.	40	10	14	30
4	Dia Rhodou.		9	14	15
	350.	30	8	14	0
3	Dia Alexandrias.		7	13	45
	370.		6	13	30
2	Dia Scienes.		5	13	15
	420.		4	13	0
1	Dia Meroes.	20			
	465.		3	12	45
	765.	10	2	12	30
			1	12	15

This neyther Line diuided into degree, ſignifieth the Equinoctiall Line, vnder which thoſe that dwell haue no Latitude, and therefore they haue alwayes twelue houres day, and twelue houres night.

But you haue to vnderſtand, that whereas Ptolomey maketh the furtheſt North part of his ſeuenth Clime, called Dia Ripheos, to haue but 50. degrées and 30. minutes of Latitude, the moderne Coſmographers do allow to thoſe mountaines 70. degrées of Latitude, affirming the ſame to be thoſe ſelfe mountaines which are otherwiſe called Montes Hyperborei, which becauſe they encloſe a great part of the North ſide of the World, are called Orbis terræ cingulum, that is to ſay, the Girdle of the world, the wrong latitude whereof, and of diuers other, I thinke Ptolomey had from other, and not from himſelfe.

For being brought vp in ſo warme a ſoile as Alexandria ſtandeth in, he could neuer endure to go ſo farre Northward, to take the Latitude of thoſe cold Riphean Mountaines, and therefore if you liſt to know, what latitude doth truly belong vnto euery Clime & Parallel, then reſort to Orontius his Table of Climes and Parallels, ſet downe in my Spheare, which ſheweth how many degrées of Latitude euery Parallel hath, together with the longeſt day, euen from the Equinoctiall to the very Pole: wherefore I leaue to ſpeake héere any further thereof, and ſo for this time end this Treatiſe.

Now heere followeth the order of making *Ptolomie* his
Tables, and of all other Maps, both vniuerſall
and particular.

How to deſcribe in manner of a Table, like vnto the Tables of Ptolomie, *any Countrie or Region, and all the places contained therein, by knowing their Longitudes and Latitudes.*

AS for example, you would deſcribe the Countrie of France, which containeth in Latitude 10. degrees, and in Longitude 16. Heere firſt you muſt draw a perpendicular line through the middeſt of your Table or Card from head to foot, ſignifying the Meridian or Axletree of the world, marked with the letters E. F. as you may ſee in the former Table of France, and diuide that line into tenne equall parts, then draw two Parallel lines: whereof the one muſt croſſe the ſaide line aboue in the point e. with right angles, and the other Parallel muſt croſſe it againe beneath in the point f. with like angles, and marke the vppermoſt Parallel with A.B. and the nethermoſt Parallel with C. D. Then with your Compaſſe take one of the 10. parts of yͤ ſaid line e.f. which is one degree, and ſet that downe by it ſelfe, diuiding the ſame into 60. minutes, as the ſhort line G.H. ſet downe on the right hand of the former table of France doth ſhew: And hauing learned by ſome Table or Mappe, that the fartheſt part of France Northward, through which the Parallel A.B. paſſeth is diſtant from the Equinoctiall, 52. degrees, and that the South Parallel C.D. is diſtant from the Equinoctial 42. degrees, and alſo hauing learned by another Table, called yͤ Table of miles here following, that to euery degree of the Parallel 42. marked with A.B. doe belong 37. miles, and that to euery degree of the parallel marked in C.D. belongeth almoſt 45. miles, Take therefore with your Compaſſe from the ſhort line G.H. 37. parts or minutes, and keeping your Compaſſe at that wideneſſe, diuide the parallel A.B. into 16. equall ſpaces anſwerable to that wideneſſe (that is to ſay) 8. parts on each ſide of the Meridian E.F. at which Meridian you muſt beginne to meaſure towards either hand, both right and left, ſetting downe a pricke at the end of euery ſuch ſpace. Then for the South Parallel C.D. take from the ſhort line G H. 45. parts or minutes, and diuide that Parallel into 16. ſpaces, anſwerable to that wideneſſe of the Compaſſe, ſetting downe eight ſuch ſpaces on each ſide of the Meridian E F. beginning to meaſure from the Meridian E F. as before, and ſet downe at the end of euerie ſuch ſpace a pricke, then from thoſe prickes, ſo ſet in each of the two Parallels A B. and C D. draw right lines, from pricke to pricke, and thoſe ſhall be Meridians, ſhewing as well the longitude of the whole Region, as of euery particular place contayned therein.

Then like as the Meridian E F. is diuided into 10. equal parts: ſo diuide againe into the like parts each of the two outermoſt Meridians, as well that on the left hand, at that on the right hand, ſetting downe a pricke at the end of euery ſuch ſpace, and from pricke to pricke draw right lines paſſing through all the Meridians, and thoſe ſhall bee the Parallels, and in the outermoſt ſpaces write the numbers as well of longitude as of Latitude, beginning your Longitude at the outermoſt Meridian on the left hand, which is the furtheſt Meridian Weſtward as wel aboue as beneath.

And becauſe that the furtheſt Meridian Weſtward is foureteene degrees diſtant from the Meridian of Inſulæ fortunatæ, which of all the ancient Geographers is counted the firſt Meridian: remember therefore to ſet downe in the firſt ſpace on the left hand, as well aboue as beneath, in Arithmetical figures 15. and in the ſecond ſpace 16. and in the third ſpace 17. and ſo proceede from ſpace to ſpace till you come at 30. for betwixt 14. and 30. are contained 16. degrees, ſo haue you the whole longitude of France, which is 16. degrees.

Thus hauing ſet downe the numbers of the degrees of Latitude, beginning at each ende of the South Parallel C D. and ſo proceede vpward alongſt the two outermoſt Meridians, ſetting downe in the firſt ſpace of the very foote of the Table 43. degrees, as well on the right hand, as on the other, and in the ſecond ſpace 44. and in the third ſpace 45. and ſo proceede vpward to 52. ſo haue you the whole latitude of France, for betwixt 42. & 52. are contained iuſt ten degrees, and if your Card be be large enough, you may diuide euery ſuch ſpace or degrée, as well of Longitude, as of Latitude, into ſixe parts, euery ſuch part containing ten minutes.

Now to place Cities, or Caſtles, Riuers, Mountaines, or ſuch like, you muſt learne the Longitude & Latitude of yͤ ſame place, eyther by Ptolomies Tables; or by ſome more moderne Table or Map, and then ſet them downe in your Carde or Table accordingly. As for example, ſuppoſe that you would firſt ſet down in the ſaid Table the chiefe town of France, called Paris, whoſe Longitude, you find by Ioliuits Card, to be 23. degrées, and 0′. the Latitude thereof to be 48. degrées. Here you muſt ſéeke out the ſaid Longitude by extending a thread from the 23. degrée of the Parallel A B. to the like degrée in the Parallel C D. and there holding it faſt, croſſe that thread with another thread extẽded from the Meridian A C. to the Meridian B D. in thoſe two points, in which are ſet downe 48. degrées 10. and whereas the two threads do croſſe, there make a little round o. and write thereon Paris, for that is his place, and as you haue ſet downe this City, ſo you may ſet downe Orelans, Roane, Lyons, Toloufe, as you ſée in the former Table of France, and in like order you may ſet downe all other places & Cities whatſoeuer.

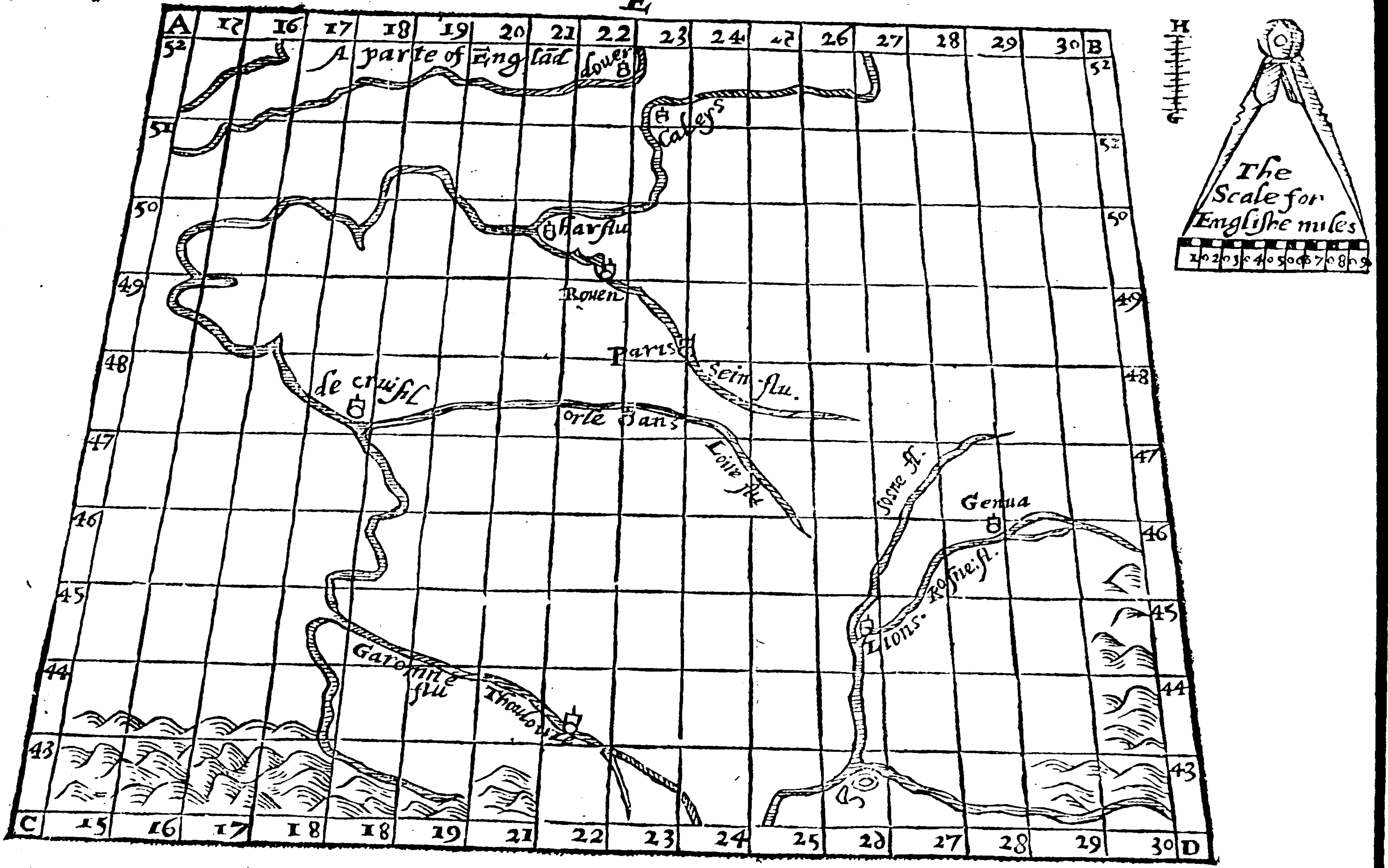
But when you would deſcribe any Riuer, then you muſt take the Longitude and Latitude, as well of the beginning as of the ending thereof; and alſo the Longitude and Latitude of their bowts in and out, and to conſider by what Towne ſuch Riuers doe paſſe, and on what ſide, and whether they paſſe through the middeſt of any Towne or not, and what notable Bridges are built ouer the ſame, and by like meanes you may place in your Carde, Woods, Forreſts, and Mountaines, and all other places whatſoeuer.

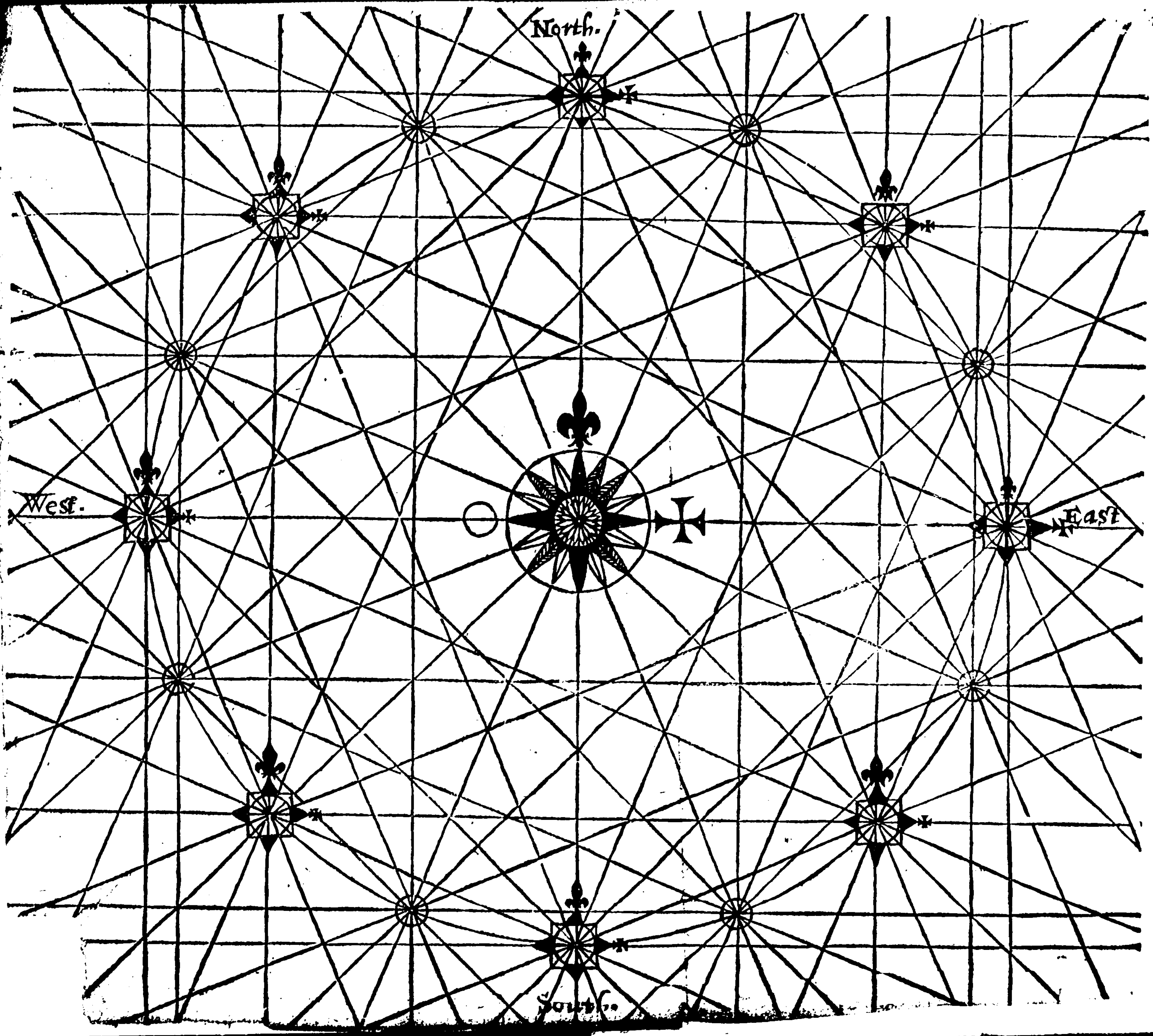
And you haue to note that all great Riuers doe commonly fall either into the Sea, or elſe into ſome great Lake, and the ſmall Riuers doe fall into the great Riuers.

Now to make a ſcale to your Carde, there is no more to doe but to know the diſtance betwixt any two places, either by relation or by your own experience, and then to draw thrée parallel

lines

The Mappe of France.




North.
West.
East.
South.

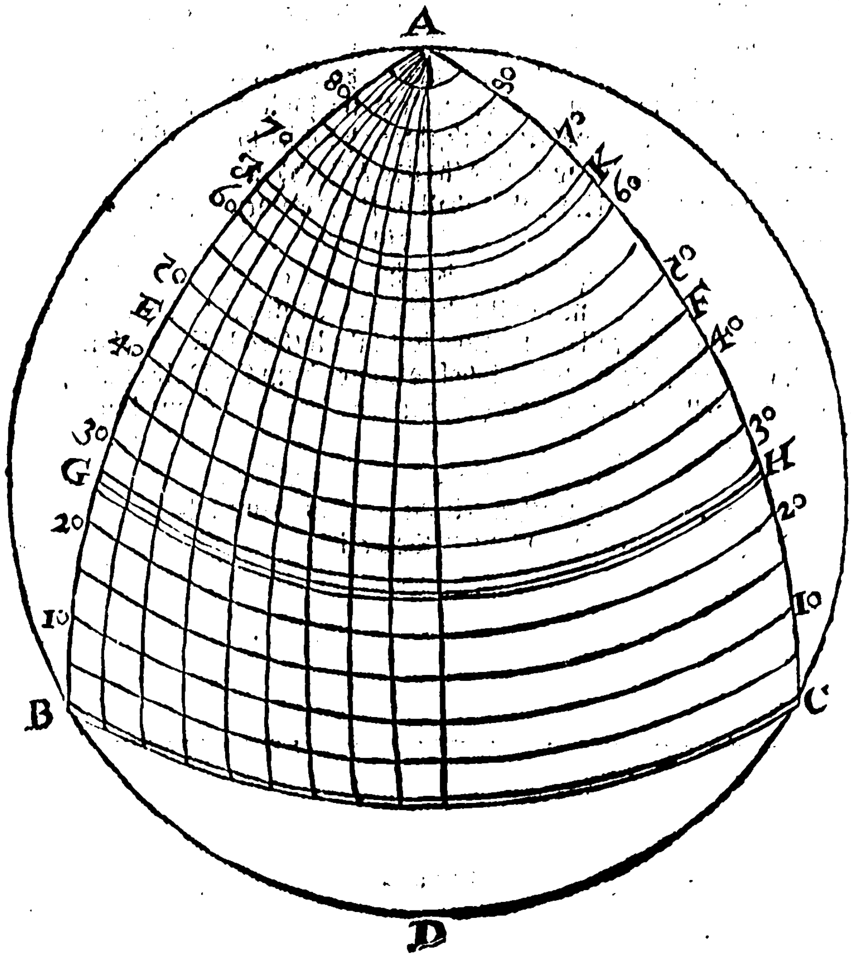
lines,making two ſpaces,one larger,and another leſſer,in ſome voide ſpace of the Card, of ſuch length as that voide ſpace will giue you leaue, & to diuide the ſaid ſcale into ſo many miles as the length of the ſaid voide ſpace will ſuffer you, and that according to the quantity of the miles of diſtance firſt knowne. As for example, you know the diſtance betwixt Paris and Roane,to be 30.French leagues,which is of our miles 60.allowing 2.miles. to a French league : wherefore diuide your ſcale into 30.equall parts accordingly, and ſet downe numbers in the larger ſpace thus,10.20.30.and ſo forth, ſo farre as your voide ſpace will giue you leaue,and by taking with your Compaſſe the diſtance of any two places ſet downe in the Card,and applying the ſame to the ſcale,you ſhall know thereby how many miles ſuch diſtance containeth, and to that end the narrow ſpace would be diuided into 10.ſmal & equal parts, betokening ſingle miles or leagues, as you ſee heere in yͤ ſcale ſet downe vnder the Table of France, and ſee that the knowne diſtance of the two places, whereby you make your ſcale, may containe ſuch number of leagues or miles as doe end in an Article, as in 10.20.30.

But one thing you haue to remember, that though in making theſe kinds of Cards or Tables, you be willed to drawe right lines from pricke to pricke, aſwell to deſcribe the Meridians as the parallels, yet ſuch lines would be drawne with blacke lead, ſo as they may be all wiped out, ſauing where as they croſſe one another in the outermoſt ſpaces, wherein you haue to ſet downe the degrees and minutes, as well of Longitude as of Latitude: for otherwiſe thoſe right lines in ſmall Cards, would ſomewhat hinder and diſgrace your worke, neither ſhould it be like in all points, to thoſe of Ptolomie, and of all other moderne Writers, deſcribing any Countrey, in like manner, in whoſe Tables neither the Meridians, nor the Parallels are to be ſeene, but onely in the outermoſt parts, as is before ſaid.

Heere place the Map of *France*.

How to deſcribe ſome particular Region or part of the earth, in ſuch ſort as both the Meridians and the Parallels may be like circular lines, and may be to the eight part of conuex ſuperficies of a Globe.

FIrſt drawe a Circle of ſome large quantitie, and diuide the ſame into three equall parts, marked with the letters A.B.C. and let A.be placed aboue, and B.C.beneath, as you ſee in the figure following. Then putting the firme foote of your compaſſe in A. extend the other foot to B. or C. and draw an arch or portion of a Circle, which may paſſe through B.C. and keeping your Compaſſe at that wideneſſe, ſet the firme foot in C. and draw the like arch from B.to A. and thirdly, ſet the firme foot in D. and draw the like arch from A. to C. and ſuppoſe A.to be the North pole, and the arch B.C.to be a quadrant, or fourth part of the Equinoctiall line, and ſuppoſe AB.and AC.to be the ſides or Meridians of other two quadrants: which two quadrants, together with the third quadrant BC.doe incloſe the eight part of the conuex ſuperficies of the Globe, That done, diuide the arch BC.into two equall parts, with the right line AD.which line AD. you muſt diuide into 9.equall parts, or into 18.parts, containing in all 90.degrees, ſo ſhall euery ſpace containe fiue degrees. That done, ſet the firme foot of your Compaſſe in the point A.and draw with the other foot ſo many Parallels as there are points of diuiſion in the right line AD. making in all 18. Parallels, which Parallels, muſt extend to the two ſides AB.and AC. Then diuide the quarter BC. in like manner into 18. equall parts, and alſo diuide the middle Parallel, marked with letters EF. into 18.equall parts, that done, draw through euery diuiſion of the quadrant BC. and alſo through the diuiſion of the Parallel EF. Meridians anſwerable to the ſame, ſo as they may meete in the Pole A.of which Meridians, AD.is a right line, and to doe that rightly you muſt find out a ſeuerall Centre for euery one of the ſaid meridians, which is not eaſily done, vnleſſe you haue an inſtrument meet for the turne, and ſpecially if the Card be of any greatnes, & hauing drawne your Meridians, ſet numbers to euery one of the three quadrants, beginning to count the firſt 90.from B.to C.and ſecondly, from B.to A.and thirdly, from C.to A.that done, count in the Meridian AD.from D. vpward 23. degrees, and 28.minutes, which in theſe daies is the greateſt declination of the Sunne, and there hauing made a pricke in the ſame line, put the firme foot of your Compaſſe in the Pole A. and extend the other foot to the foreſaid prick, through which you muſt draw a Parallel from the ſide AB. to the ſide AC.and marke the ſame with the letters GH. for that ſhall be the Tropicke of Cancer, then with your Compaſſe take the diſtance that is betwixt D. and the foreſaid Tropicke, and keeping your Compaſſe at that wideneſſe, ſet the firme foot thereof in A.and with the other foote draw another Parallel, marked with the letters I. K.and that ſhall be the Circle Articque, whoſe diſtance from the Pole is alwaies equall to the greateſt declination of the Sunne, and thus your Card is ready to deſcribe therein any Region or Country, whereof the Longitude doth not exceed 90. and that it hath North Latitude, as this figure following plainly ſheweth.



How to make a Card, hauing circular Meridians, and circular Parallels, like to thoſe of the Globe, to deſcribe therein which halfe of the world you will, ſo as it may repreſent the one halfe of the terreſtriall Globe.

First, vpon the point or centre E. which is to be ſet downe in the very middeſt of the Card, which you minde to make, draw 3.circles, one within another, making two ſpaces, in ſuch ſort as the outtermoſt ſpace may haue ſome breadth, to containe therein the number of degrées to be written in Arithmeticall figures, and let the innermoſt ſpace, be a very narrow ſpace, fit to containe the degrées, as you ſée in this preſent figure, that done, diuide yͤ innermoſt circle into 4.quarters, with two Diameters croſſing one another, with right angles in the centre E. and mark the perpendicular Diameter with the letters AC. whereof A. ſignifieth the North Pole, and C. the South Pole, and marke the ouerthwart Diameter, ſignifying the Equinoctiall with the letters BD. whereof B. is the Weſt point, and D. the Eaſt point, then diuide euery quarter into 90. degrées, beginning to account from B. to A. and alſo from D. to A. vpward, and from B. to C. and likewiſe from D. to C. downward, then apply your ruler to the Pole A. & to the fiſt degrée of the innermoſt circle, precéding from B. to C. and whereas your ruler croſſeth the Equinoctiall, there make a pricke vpon the Equinoctiall, and ſo procéed towards C. from 5. degrées to 5. degrées, and againe from C. to D. in like manner, not forgetting to ſet downe prickes vpon the Equinoctiall at euery ſection, ſo ſhall you diuide the Equinoctiall into 180. degrées, counting from B. to D. and therfore you muſt ſet downe vpon the Equinoctiall, the numbers of the degrées, thus, 10.20.30. and ſo foorth, vntill you come to 80. as you ſée in the former figure. Then by laying the one ende of your ruler to B. and the other end to euery fiſt degree of the Semicircle A.D.C. diuide the Meridian A.C. as you did before diuide the Equinoctial B. D. making prickes or ſtrikes vpon euery ſeaſon or diuiſion of the ſame Meridian A.C. and theſe two lines (that is to ſay) the Equinoctiall line, and the Meridian line being thus diuided, you muſt draw vpon the two Poles A. C. Geographicall Parallels, whereof you may draw two by ſetting the one foote of your Compaſſe in the Pole A. and the other foot in the firſt ſection of the Meridian A.C. that is next vnto A. and kéeping your compaſſe at that wideneſſe, you may make the like Parallel vpon the South Pole by ſetting the one foot in the point C. and the other in that ſection of the ſaid Meridian that is next vnto C. but to find out the Centres of all the reſt of the Parallels, both Northward and Southward, you muſt draw out the line A.C. at both ends ſo long as you can, for in that line you haue to find out all the Centres, which Centres muſt be ſuch as the firme foote being ſet therein, the other féet may paſſe through euery ſection of the Meridian line, and alſo through euery fift degrée of the inward Circle, containing the degrées on both ſides of the ſaid Meridian, and hauing drawne after this manner the 18. Northerne Parallels, you may eaſily draw the other 18. Southerne Parallels, by marking well the firſt Centres of the Northerne Parallels, taking the iuſt diſtance of euery one with your Compaſſes, and by ſetting downe the ſam vpon the Meridian line A.C. on the South part thereof.

Now to deſcribe the Meridians, you muſt draw out the line B. D. at both ends ſo farre in length as ſhall ſuffice, in which line you haue to find out the Centre of euery Meridian, firſt of thoſe in the Weſt part, and then of thoſe in ẏ Eaſt part, by ſetting the one foot of your Compaſſe in the Centre, and the other foote ſo as it may paſſe through euery ſection of the line B.D. & alſo through both the Poles, & hauing drawn the Weſternly 18. Meridians, you ſhall eaſily draw the Eaſternly Meridians, by reducing the ſelfe ſame diſtances of Centres vnto the Weſt part, by helpe whereof, you did draw the Eaſterly Meridians, or elſe you may draw, firſt a Weſt Meridian, & then an Eaſt Meridian, whileſt the Compaſſe is at one ſelfe wideneſſe, and thereby you ſhall draw 2. Meridians at one inſtant, and you may alſo obſerue the like order in drawing the North & South Parallels before mentioned.

Then you haue to draw the two Tropiques, & the two Polar Circles in manner and forme following: firſt to draw the Tropicke of Cancer, ſet one foot of your Compaſſe in the Centre C, and the other foot in the Meridian or line A. E. at ſuch diſtance as is the greateſt declination of the Sunne, which is 23. degrées, and 28. minutes, and there ſet downe a pricke or marke, then as well from D. towards A. as from B. to A. count the ſaid greateſt declination of the Sunne, which is 23. degrées 2′8. and there make a marke on the innermoſt of the thrée outward Circles on both hands, that done, ſéeke a Centre vpon the excended line A. F. ſo as from thence you may draw a Circle that may paſſe through the thrée markes laſt mentioned, and that ſhall be the Tropique of Cancer, then kéeping your Compaſſe ſtill at that wideneſſe, transferre the ſame to the extended line C.G. ſetting the firme foot, ſo as you may draw with the other foot another Circle, that is of like diſtance from the Equinoctiall, and that ſhall be the Tropique of Capricorne.

Now to draw the Polar circles, you muſt doe thus. Number vpon the firſt Meridian A. C. from ẏ Pole towards E. the greateſt declination of the Sunne, and there make a marke, and againe, from the Pole vpon the innermoſt Circle on both ſides of the Meridian, count the like quantity of degrées, and marke the ſame quantity vpon the firſt Meridian, then hauing found the centre in any of the extended lines belonging to the Poles, draw a Circle through thoſe thrée markes, and the Circle drawne towards A. ſhall be the Circle Artique, and the other drawne towards C. with like widenes of your compaſſe, ſhall be the Circle Antartique, & ſo your Card is ready to deſcribe therein what places you will, knowing the Longitude and Latitude thereof, and that the Longitude doe not excéed aboue 180. degrées. And I take this forme of Card to be the beſt both for Sea & Land: for euery Region therein deſcribed muſt néeds haue his true ſhape, ſo as you know the true Longitude and Latitude of the outermoſt bonds and limits thereof.

Beſides theſe manner of Maps, Plancius ſetteth downe the whole earth in two ſeuerall rundles, each one containing ẏ iuſt halfe of the earth, that is to ſay, the North halfe, and the South halfe, making the Equinoctiall in each halfe the outermoſt circle, and the Centre of the North rundle ſignifieth the North Pole, and the Centre of the South rundle, ſignifieth the South Pole, which manner of Map, becauſe I haue already plainely ſet downe together, with the vſe thereof in my deſcription of Plancius his vniuerſall Map, I leaue to deale any further therewith, I haue ſéene alſo many yéeres ſince an vniuerſall Map made by a French-man, which was round in ſhape like vnto a Planiſpheare, hauing both the Poles placed in the very centre thereof, which Map becauſe I cannot get héere in England for any money, I am forced to leaue vndeſcribed, and in ſtéed thereof I thinke good to ſet downe héere, the deſcription of a very good Map of Europe, made by Mercator in the yéere of our Lord, 1554. becauſe the manner of making the ſaid Map, doth greatly pleaſe me.

Maſter Blundeuile *his Deſcription of an excellent good Map of Europe, made by Mercator in the yeere of our Lord,* 1554. *in which deſcription is firſt ſhewed the manner of making the ſayd Map, and then the vſe thereof.*

FIrſt, the ſaid Mercator conſidered what Longitude and Latitude Europe hath, and knowing partly by yͤ ancient Tables of Ptolomy, and ſuch others, but chiefly and moſt truely by the moderne Maps and Sea Cards, that Europe had in Longitude no more then 70. degrées, counting from the firſt Meridian, paſſing through the Iles Canary, otherwiſe called Inſulę Fortunatæ, vnto yͤ Meridian which paſſeth through the floud Tanais, which is the vttermoſt bound or limit of Europe, towards the Eaſt, diuiding the ſame from Aſia, yet becauſe he thought good to ſet downe in his Map a good part of Aſia, whereon Europe abutteth or bordereth towards the Eaſt, he made the ſaid longitude in his Map to extend Eaſtward 100. deg. euen to yͤ further ſide of the great floud Obye, & thought he found by the aforeſaid

Table

Tables and Sea cards, that the latitude of Europe was no more but 40. degrées, counting from the Parallel of 30. degrées of North Latitude, vnto the Parallel of 70. degrées of North Latitude, yet he maketh his Map to extend farther, as well Northward as Southward, as you may plainely ſée in beholding the ſaid Card. Theſe things being preſuppoſed in the way of preamble, I will now ſhew you what order be obſerued in making the ſaid Card. Firſt, he drew a right perpendicular line through the midſt of his Card, which he calleth the middle Meridian, ſignifying the Axle-tree of the world, which line he extended right out a good way Northward beyond his Map, about the quantity of the third part thereof, to the intent that the North end of that line, ſignifying the North pole, might be the Center wheron he had to draw all his Parallels, contained betwixt the 30. degrees, and 70. degrées of North latitude: and for that purpoſe he diuided with his Compaſſe the middle Meridian, being ſo extended from the 30. Parallel to the very Pole, into 12. equall parts or ſpaces, and euery ſuch ſpace into 5. degrées, which maketh in all 60. degrées, counting thoſe degrées from the nether end of the middle Meridian, croſſing the 30. Parallel vnto the foreſaid Centre, vpon which Center, ſetting the firme foot of his Compaſſe, and extending the other to the lower end of the ſayd middle Meridian, whereas it croſſeth the 30. Parallel, he draweth his firſt Parallel ſo farre on both hands as his Card will ſuffer him, which Parallel, according to the quantitie of the ſpace of the degrées, he draweth through the prickes of diuiſion, ſet downe in the middle Meridian, the reſt of the Parallels vntill hee come to the 70. degrées of North Latitude, that done, hee diuideth as well the vpper Parallel as the nether Parallel, each of them into twenty equall parts or ſpaces, euery ſpace containing fiue degrées, through which diuiſions hee draweth his Circular Meridians, or rather portions of Circular Meridians, ſome greater, ſome leſſer, by finding out fit Centres to drawe thereon the ſaid portions of Circles, on both ſides of the middle Meridian, through thrée ſeuerall prickes or points, whereof one muſt bee alwayes that which ſignifieth the North Pole, which is cleane without the Card, and the other two

prickes

prickes, are to be ſought in the two Parallels that are diuided, as before each of them into 20. parts, which 2. prickes muſt anſwer one another, according to the like number of degrees of the ſayd 2. Parallels, as 10. to 10. 20. to 20. and ſo forth. As for example, ſuppoſe that you would draw a Meridian that may paſſe through the 20. ſection of the thirty Parallel, and alſo through the twentie ſection of the 70. Parallel, and thirdly through the Pole: here to find out an apt Centre to draw this Meridian, it is not eaſie, vnleſſe you haue an Inſtrument meet for the purpoſe, like to that which Maſter Blagraue ſetteth downe in the fourth Booke of his Mathematicall Iewell, Chap. 20. made according to the doctrine of Euclide: for to find out all the Centres of the ſaid Meridians in this little Card, according to Euclide his rule of drawing a Circle through three prickes, would require an euen floore, almoſt 40. foot ſquare.

Thus hauing drawne the Parallels and Meridians of his Card, hee ſetteth downe therein all ſuch notable places as are contained in Europe, as Townes, Riuers, Seas, Iland, Mountaines, and ſuch like, as well according to their true longitudes, and latitudes, as alſo according to their due direction, that is to ſay, how one place beareth from another, as Eaſt, Weſt, North, or South, and ſo forth: wherein hee was greatly holpen by the Sea Cards lately made by ſkilfull Pilots. And it ſeemeth by the Card whereby I made this deſcription, that Mercator had an intention to ſet downe in the ſaid Card certaine Flies of direction, to ſhew thereby how euery place doth beare each one from another, which Flies though they doe not all plainely appeare, yet the print of ſome of them is ſtill to be ſeene in the ſayd Card. I thinke that Mercator cauſed them to be cancelled for feare of occupying too much roome in his Card, and thereby to hinder the view of many places, needfull to be ſet downe in the ſaid Card.

Moreouer, hee addeth to his ſaid Card three ſeuerall Scales, one of latitude, the ſecond of longitude, and the third of diſtance: By the firſt you may eaſily find out the true latitude of any place, and by the ſecond the true longitude of any place contained in the ſaid Card, and by the third Scale you may know how many miles, according to the diuerſity of miles in euery ſeueral Region, one place is diſtant from another, the deſcription & vſe of all which three Scales hereafter followeth.

The deſcription and vſe of the Scale of Latitude.

The ſcale of latitude conſiſteth of 4. right lines, making three colums, euery one cõtaining in length one ſuch whole ſpace as is contained betwixt any two Parallels, ſet downe in the Map, and as euery ſuch ſpace is diuided into 5. degrees, ſo likewiſe is the length of the ſcale, as you may ſee by the number ſet downe in the firſt colum on the left hand, thus, 1. 2. 3. 4. 5. & euery degree is diuided into 6. equall parts, as you may perceiue by the ſecond colum, and euery ſuch part is diuided into 10. as you may perceiue by the third colum, ſo as euery whole degree is diuided into 60. the vſe of which ſcale is to find out the true Latitude of any place contayned in the Map, thus.

Set the one foot of your Compaſſe in the place whoſe latitude you ſeeke, extending the other foot to the Parallel which is next vnto that place, which Parallel if it be beneath the place, then apply that wideneſ of your Compaſſe vnto the lower part of yͤ ſcale, by ſetting the one foot thereof at the loweſt end of the ſcale, and the other foot vpward ſo far as the widenes wil extend them looke how many degrees & minutes are contayned betwixt the 2 feet of your Compaſſe, & adde that vnto the number of the aforeſaid Parallel ſet downe in the Map, and the ſum thereof ſhalbe the latitude of the place. But if you doe extend your Compaſſe from the place, whoſe latitude you ſeek, to yͤ next parallel aboue it: then you muſt apply that wideneſſe of your Compaſſe to the vpper part of the ſcale, ſetting one foot of your Compaſſe in the very top thereof, and the other downward ſo far as that widenes will reach, then looke how many degrees and minutes are contayned betwixt the two feet of your Compſſe, and ſubtract that from the number of the ſaid vpper Parallel ſet downe in the Map, and the remaynder ſhall be the latitude of that place.

As for example, you would know the latitude of Rome, which is is the chiefeſt Citie in Italie. Here hauing found out Rome in the Map, you muſt firſt ſet one foot of the Compaſſe in that verie place, extending the other foot vnto the next inferiour Parallel, that done, keeping your Compaſſe at that wideneſſe, apply the ſame vnto the ſcale, by ſetting one foot at the loweſt end of the ſcale, and the other vpward ſo farre as that wideneſſe wil reach, then looke how many degrees and minutes are contayned betwixt the two feet of your Compaſſe, and you ſhall find it to be one degree 4′8. which being added to the number of the foreſaid next inferiour Parallel, which is 40. ſet downe in the Map, it will make in all 41. degrees 4′8. & that is the latitude of Rome. But if you do extend your Compaſſe from Rome to the next vpper parallel, then ni applying the widenes to yͤ ſcale, you muſt ſet one foot of your Compaſſe in the very top of the ſcale, & the other downward, ſo farre as that wideneſſe will extend, and by looking how many degrees and minutes are contayned betwixt the two feet of your Compaſſe, you ſhall finde them to be three degrees twelue minutes, which being taken from 45. which is, the number of the next vpper Parallel, there will remayne 41. degrees 4′8. as before.

Then hauing the latitude of Rome, you may eaſily finde out the longitude thereof by helpe of the ſcale of longitude, ſet downe in the Map, the deſcription and vſe whereof hereafter followeth.

The deſcription and vſe of the Scale of longitude.

THis Scale, as you ſee, conſiſteth of 30. long right lines, ſignifying Meridians, drawne from the left hand toward the right, whoſe ſpaces doe waxe ſtraiter and ſtraiter towards the Pole, which Meridians are croſſed with 40. Circular Parallels, proceeding orderly from the 30. Parallel to the 70. euerie one ſhorter then other towards the Pole, as you may perceiue by the Number ſet downe, as well aboue as beneath the Scale, and as the firſt and greateſt Parallel on the left hand, is diuided into fiue degrees, and euery degree into ſixe parts,

ſo

ſo is euery other Parallel, be it neuer ſo ſhort, the vſe of which Scale is thus. Firſt, hauing found the latitude of any place by helpe of the Scale of Latitude before deſcribed, you muſt keepe your Compaſſe ſtill at the wideneſſe of the Latitude firſt found, and apply that ſame widenes vnto that Meridian, which is neereſt vnto the place, by ſetting one foot in the former Parallel, whereas the next Meridian doth croſſe the ſame, extending the other foot vpon the ſaid Meridian vpward, ſo farre as that wideneſſe will ſuffer, and there make a pricke, in which pricke ſet the one foot of your Compaſſe, and extend the other to the place, and apply that laſt widenes to the Scale of longitude, by ſetting the one foot in the nether ſide of the Scale, at the very latitude before found, & extend the other vpon the ſame Parallel of latitude, ſo farre vpwards as that wideneſſe will ſuffer: then looke how many degrees and minutes are comprehended betwixt the two feet of your Compaſſe, and adde that to the number of the foreſaid next Meridian, ſet downe in the Map, and if the ſame Meridian, be on the left hand of the place, then it is weſterly from yͤ place, but if the next Meridian, which you take, be on the right hand, ſtanding on the Eaſt ſide of the place, then you muſt ſubtract the degrees and minutes, found in the Scale of Longitude, from the number of that Meridian, ſet downe in the Map, & the remainder ſhall be the Longitude of the place. As for example, hauing found yͤ Longitude of Rome, by helpe of the Scale of Latitude, to be 41. degrees 4′8. as is aforeſaid, here keeping your Compaſſe ſtill at the former wideneſſe, apply the ſame to the next Merinian on the left hand, by ſetting one foot in that point, whereas the ſaid Meridian croſſeth the Parallel of latitude, and the other foot ſtill vpon the ſame Meridian vpward, ſo farre as that widenes will extend, and there make a prick, in which prick hauing ſet the one foot of your Compaſſe, extend the other foote to the place where Rome ſtandeth, that done, apply that laſt wideneſſe of your compaſſe vnto yͤ nether part of the Scale of longitude, by ſetting the one foote in the very degree and minute of the former found latitude, and the other foot vpon the ſame degree and minute of latitude. Then looke how many degrees and minutes are comprehended betwixt the two feet of your Compaſſe, which you ſhall

finde

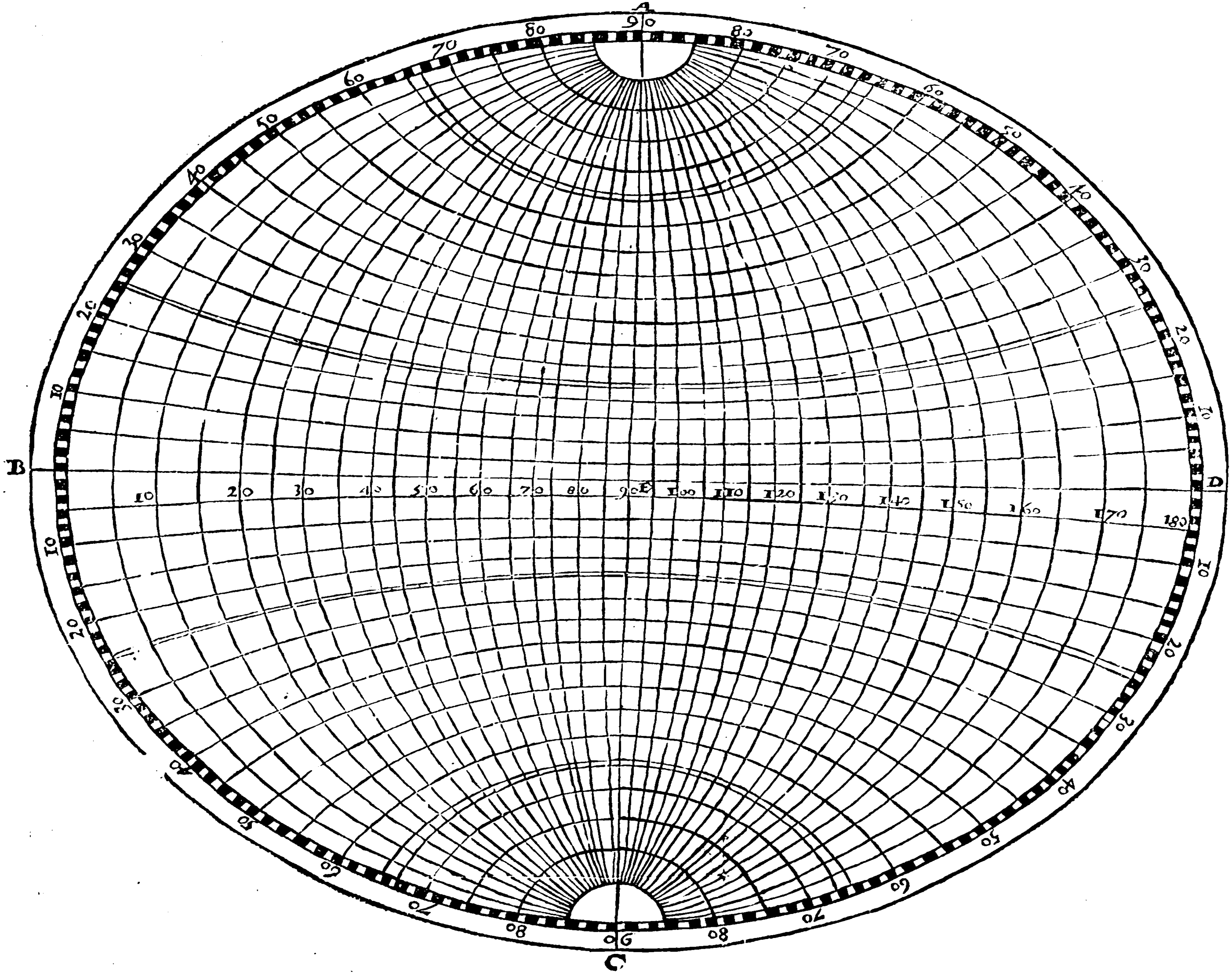
find it to be 1. degrée, 1'0. and by adding that to the number of the next Meridian on the left hand, ſet downe in the Map, which is 35. degrées, it maketh in all 36. degrées, 1'0. and that is the longitude of Rome. But if you make choice of the next Meridian on the right hand, whoſe number is 40. degrées, then you muſt ſubtract the degrées and minutes, contained betwixt the two féet of the Compaſſe, which you ſhall find to be 3. degrées, 5'0. out of the next Parallel on the left hand, which is 40. degrées, and there will remaine 36. degrées, 10. minutes, as before.)

The Scale of diſtance.

THis Scale néedeth no deſcription, becauſe it is plainely ſet downe in the Map, ſhewing the diuerſitie of Leagues or miles, belonging to euery Nation or Region, wherefore if you would know the diſtance betwixt any two places, ſet downe in the Map, you haue no more to doe, but to take with your Compaſſe the iuſt diſtance betwixt theſe two places, & to apply that wideneſſe to the Scale, by ſetting the one foot of your Compaſſe in the beginning of thoſe miles, that are anſwerable to the Region, or rather to thoſe kind of miles which you ſéeke to know, and extend the other foot vpon that part of the Scale, ſo farre as that wideneſſe will ſuffer you, and the number of miles comprehended betwixt the two féet of your Compaſſe, will ſhew you the true diſtance betwixt the two places. By this meanes you ſhall find the diſtance betwixt Rome & Naples, to be 120. miles, but if the diſtance of the two places, ſet downe in the Map, be longer then the Scale it ſelfe, then you muſt firſt take the whole length of that part of yͤ ſcale, which is anſwerable to theſe miles which you ſéeke, & by kéeping your Compaſſe at that wideneſſe, to meaſure by a right line how many times the ſaid wideneſſe, is comprehended betwixt the two foreſaid places, and the number of miles ſhall be the diſtance: but if there be any odde meaſure, then you muſt ſtraighten your Compaſſe to anſwer yͤ odde meaſure, & apply that wideneſſe to the beginning of the a foreſaid Scale, and adde that to the former number, whoſe totall

ſumme

Place this at Folio, 798.



ſumme ſhall bee the diſtance betwixt the two places.

Moreouer you ſhall find on the right ſide of this Map, the Peregrination of the Apoſtle S. Peter, and right vnder that, the Peregrination of S. Paul, ſhewing in how many places they preached the Word of God, what Miracles they did, and where. And in the foot of the Map on the right hand is ſet downe the Peregrination of Ieſus Chriſt, ſhewing the places where hee preached or did any great Miracles.

Finally, about the middeſt of the Map, you ſhall find certaine Characters, ſhewing which Townes are the ſeats of Biſhops, Archbiſhps, Patriarkes, Popes, and ſuch like.

And thus I end, praying you to take my labour herein beſtowed, well in worth, which I would not haue done, but that I know this Card to be a neceſſary Card, and to be made with very good Art, according to the Example of which Card, the ſonne of old Mercator hath lately cut forth diuers ſmall Cardes of Europe, traced with lines and circles, like to theſe his Fathers Card, the vſe of which lines and circles, I feare me, that few doe rightly vnderſtand, & for that cauſe I was the more willing here to ſet downe this plaine deſcription of the Fathers Card.

FINIS.
